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D'APPOLONIA CONSULTING ENGINEERS PITTSBURGH PA F/G 13/2
NATIONAL DAM INSPECTION PROGRAM. NORTH FORK DAM. (NDS ID NUMBER--ETC(U)
JUN 78 DACW31-78-C-0049

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North Fork Dam. (NDS ID Number 234).
Ohio River Basin, North Fork Bens Creek,
Somerset County, Pennsylvania.

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

NAME OF DAM: North Fork Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Somerset
STREAM: North Fork of Bens Creek, tertiary tributary of Conemaugh River
DATE OF INSPECTION: April 24 and 25 and May 4, 1978

ASSESSMENT: Based on the evaluation of the conditions as they existed on the dates of inspection and as revealed by visual observations, the condition of North Fork Dam is assessed to be good. However, it is recommended that appropriate repairs be made to stop concrete spalling on the spillway channel walls. The spillway capacity is classified to be "inadequate" (73 percent PMF) based on the recommended criteria. However, it is not considered to be "seriously inadequate" since it can pass flows in excess of 50 percent PMF.



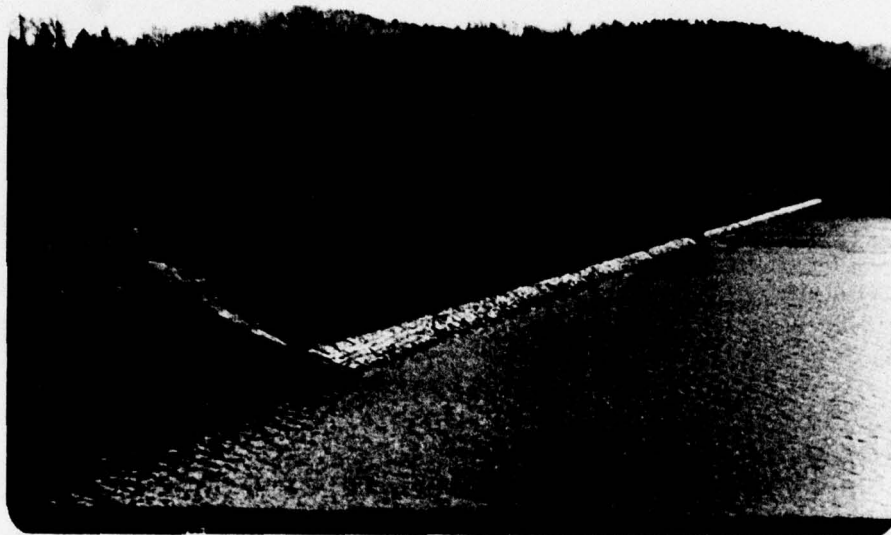
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LTC, Corps of Engineers
Acting District Engineer

DATE: *14 June 1978*

NORTH FORK DAM
NDS I.D. NO. 234
APRIL 24 AND 25, 1978



Upstream Face



Downstream Face

PHASE I
NATIONAL DAM INSPECTION PROGRAM
NORTH FORK DAM
NDS I.D. NO. 234

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. The dam consists of an earth embankment approximately 900 feet long, with a maximum height of 105 feet from the downstream toe. The combined primary and emergency spillway is located on the left abutment (looking downstream). Flow through the spillway is controlled by hydraulically operated bascule gates on an ogee section whose crest (Elevation 1525, USGS Datum) is approximately 11 feet below the dam crest (Elevation 1536). When the gates are fully raised, the control level is 8 feet below the crest (Elevation 1528). The spillway discharges into a 60-foot-wide rectangular concrete channel. Flow through the discharge channel passes over five ogee weirs and a series of steps to control flow velocity and then into a pool just downstream of the embankment toe. The outlet works for the dam consist of two 24-inch cast-iron supply lines and a 36-inch cast-iron blow-off line located near the left abutment. The 36-inch blow-off pipe constitutes the emergency drawdown system for the dam. Discharge through the pipes is controlled by valves located in a gate tower near the crest of the dam. The 8-foot-diameter concrete diversion conduit was plugged following construction. The dam impounds 3376 acre-feet of water at normal pool elevation.

b. Location. North Fork Dam is located (Plate 1) 1-1/4 miles upstream on the North Fork of Bens Creek, five miles southwest of the city of Johnstown in Conemaugh Township, Somerset County, Pennsylvania. The impounded reservoir serves as a domestic water supply source.

Downstream from the dam, the North Fork flows through a valley 500 to 700 feet wide for a distance of about 1-1/4 miles where it joins the South Fork to form the main branch of Bens Creek. The North Fork flows under a county road (Photograph 12) before flowing into Bens Creek. There are approximately six houses and a golf course in the first one-mile reach of the flood plain downstream from the dam (Plate 1). It is estimated that a failure of the dam would also cause significant loss of life and property damage along the main branch of Bens Creek.

- c. Size Classification. Large (based on 105-foot height).
- d. Hazard Classification. High.
- e. Ownership. The Greater Johnstown Water Authority.
- f. Purpose of Dam. Water supply.
- g. Design and Construction History. The dam was designed by Metcalf and Eddy, Consulting Engineers, of Boston, Massachusetts, in 1927. The dam was constructed by the Johnstown Water Company.
- h. Normal Operating Procedure. Flow through the spillway is controlled by hydraulically operated bascule gates. The gates are lowered from November 1 of every year to April 1 of the following year. When the gates are in the raised position, the pool level is maintained at Elevation 1528. When the gates are lowered, the control level is at Elevation 1525.

1.3 Pertinent Data

- a. Drainage Areas - 10 square miles.
- b. Discharge at Dam Site
 - Maximum known flood at dam site - Unknown.
 - Warm water outlet at pool elevation - N/A.
 - Diversion tunnel low pool outlet at pool elevation - Unknown.
 - Diversion tunnel outlet at pool elevation - Unknown.
 - Gated spillway capacity at pool elevation - Unknown.
 - Gated spillway capacity at maximum pool elevation - 10,500 cfs.
 - Ungated spillway capacity at maximum pool elevation - N/A.
 - Total spillway capacity at maximum pool elevation - 10,500 cfs.
- c. Elevation (USGS Datum)
 - Top of Dam - 1536 feet.
 - Maximum pool-design surcharge - Unknown.
 - Full flood control pool - N/A.

Recreation pool - N/A.
Spillway crest - 1528 feet (gates raised), 1525 feet (gates lowered).
Upstream portal invert diversion tunnel - 1429.75 feet.
Downstream portal invert diversion tunnel - 1419 feet.
Streambed at center line of dam - 1411 feet.
Maximum tailwater - 1420 feet (estimated).

d. Reservoir

Length of maximum pool - 5000+ feet.
Length of recreation pool - N/A.
Length of flood control pool - N/A.

e. Storage

Recreation pool (normal pool) - 3376 acre-feet (gates down),
3652 acre-feet (gates up).
Flood control pool - N/A.
Design surcharge (maximum) - 940 acre-feet.
Top of dam - 4316+ acre-feet.

f. Reservoir Surface

Top of dam - 118 acres.
Maximum pool - N/A.
Flood control pool - N/A.
Recreation pool - N/A.
Spillway crest - 94 acres.

g. Dam

Type - Earth fill.
Length - 900 feet.
Height - 105 feet.
Top width - 20 feet.
Side slopes - 2:1, 2.5:1.
Zoning - Yes.
Impervious core - Yes.
Cutoff - Yes.
Grout curtain - Yes.

h. Diversion and Regulating Tunnel

Type - 36-inch blow off.
Length - 580+ feet.
Closure - Valves.
Access - Yes.
Regulating facilities - Yes.

i. Spillway

Type - Concrete ogee and chute.

Length of weir - 92 feet.

Crest elevation - 1528 feet (gates raised), 1525 feet
(gates lowered).

Gates - 3 bascule.

Upstream channel - Concrete approach channel.

Downstream channel - Gabion channel.

SECTION 2 ENGINEERING DATA

2.1 Design

a. Data Available

(1) Hydrology and Hydraulics. A report entitled, Report Upon the Application of the Johnstown Water Company, dated March 3, 1927, summarizes most of the hydrologic and hydraulic data which are available for the project. The report states the criteria for the design of the spillway.

(2) Embankment. The available information includes design drawings, construction specifications, and a critique of the design included in the 1927 report.

(3) Appurtenant Structures. No design information is available.

b. Design Features

(1) Embankment. A review of design drawings and the correspondence files for the dam show the following main features of the project:

- (a) As designed, the dam is a zoned embankment with a reinforced concrete cutoff wall at the center of the dam extending from the foundation level to the dam crest for the entire length of the dam. In the design drawings, three zones were identified (Plate 3): (1) "most impervious material" at the center of the embankment, (2) an unclassified material forming the shell of the dam on both sides of the core, and (3) a shale fill on the downstream slope extending from Elevation 1500 to the downstream toe.
- (b) The embankment was designed to have two to one (horizontal to vertical) slopes from crest level down to Elevation 1500 and 2.5 to 1 slopes below Elevation 1500 on both the downstream and upstream faces.
- (c) The reinforced concrete cutoff wall as designed was anchored into the foundation rock three or four feet and the foundation below the wall was grouted through pipes

embedded in concrete (Plate 4). The wall was constructed to be three or four feet thick from foundation level to two feet above original grade, where the thickness was tapered to a constant one foot and carried up almost to the crest elevation.

- (d) The 1927 state inspection report says the preliminary subsurface investigation consisted of numerous test pits and diamond drill holes. At the center line of the dam, a 14-foot-wide, 200-foot-long trench was excavated. The depth of the trench was from 5 to 14 feet and extended through gravel overburden and soft shale to hard rock. The rock underlying the soil overburden consisted of layers of shale, sandstone, fine clay, and coal. The dip of the rock is toward the right abutment. A coal seam was found at depths 40 to 50 feet below ground surface and approximately 36 feet below the top of hard rock found at the bottom of the trench.
- (e) In the same reference, the grouting work was described as follows:

"Holes were being drilled at intervals of 12 feet and were being carried to a depth of about 26 feet below the rock surface, or about 18 inches into a stratum of hard sandstone above the coal. Two to three holes were drilled and then grouted with a thin grout consisting of one part cement and seven parts of water, following which additional holes were drilled and grouted. It is the intention to drill a third set of holes, if necessary, making the final interval 3 feet. In grouting, a section of pipe 8.5 feet long was grouted into each hole after which the hole itself was grouted. The upper part of the hard rock is more or less shattered, and this will be removed possibly to an additional depth of about 8 feet. A trench had been excavated under the new road to a depth of about 18 feet through shattered shale, and additional grouting done at this point and for about 250 feet above the road, the holes drilled at this point varying in depth from 135 to 265 feet.

This work covers a distance of from 200 to 300 feet beyond the right end of the dam."

(2) Appurtenant Structures. The appurtenant structures for the dam consist of the spillway and outlet works. The spillway structures consist of a gated spillway crest, a discharge channel, and a plunge pool. The outlet works consist of 24-inch supply lines and a 36-inch blow-off pipe. Descriptions of the appurtenant structures are included in Section 1.2.

c. Design Data

(1) Hydrology and Hydraulics. The 1927 report stated that the expected peak runoff from the drainage area was 6450 cubic feet per second (cfs), which corresponded to one inch of runoff per hour. The spillway capacity as designed was reported to be 10,800 cfs with no freeboard.

(2) Embankment. No design data are available on the design of the embankment.

(3) Appurtenant Structures. There are no design values available for the appurtenant structures.

2.2 Construction. Construction drawings and various construction progress reports and construction specifications were available for review.

To the extent that can be determined, the construction of the dam was apparently conducted in accordance with the specifications as prepared by Metcalf and Eddy.

The progress of the work was described in biweekly progress reports submitted by the owner to the Water Supply Commission of Pennsylvania (predecessor of the Department of Environmental Resources). The foundation of the dam was periodically inspected by the engineers of the state and written approvals were given for the commencement of work.

In 1959, bascule-type gates were installed in each of the three openings on the spillway crest to increase the storage capacity of the reservoir from 3376 acre-feet to 3652 acre-feet. To provide additional freeboard, the crest of the embankment was raised one foot by additional earth fill.

2.3 Operation. There are no formal operating records available for this dam. As designed, the dam serves as a water supply reservoir. The supply water from the reservoir discharges through a 24-inch pipe, controlled by valves located in the valve house at the crest of the dam and joins the transmission system.

A state construction permit issued in 1959 for the installation of the spillway gates required that the gates be maintained in a lowered position from November 1 to April 1 of each year.

2.4 Other Investigations. The available information indicated no other investigations other than the reports of periodic inspections conducted by the state.

2.5 Evaluation

a. Availability. Available engineering data were provided by PennDER.

b. Adequacy

(1) Hydrology and Hydraulics. The available information only concerns the design capacity of the spillway.

(2) Embankment. Review of the geotechnical aspects of the design indicates that in view of the age of the dam, completed in 1932, the design approach and construction techniques are not likely to be in conformance with currently accepted engineering practice. Design documents lack such considerations as embankment slope stability and seepage analyses, usually included in current practice.

However, the design incorporated such basic components as a cutoff wall extending to impervious foundation materials, foundation grouting, and toe relief wells.

(3) Appurtenant Structures. Review of design drawings indicates that as designed there are no significant design deficiencies that should affect the overall performance of the appurtenant structures.

c. Operating Records. No formal operating records are available for this dam.

d. Post-Construction Changes. In 1959, sluice gates were installed at the spillway crest. In conjunction with this work, the crest of the dam was raised by one foot to provide the required freeboard for the reservoir. A state report dated March 2, 1959, states the required spillway capacity for the dam as of the date of installation of the gates was 6800 cfs and the modified spillway has a capacity of 6930 cfs with three feet freeboard.

e. Seismic Stability. The dam is located in Seismic Zone 1 and static stability of the dam is considered to be adequate. Therefore, based on the recommended criteria for evaluation of seismic stability of dams, the structure is assumed to present no hazard from earthquakes.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of North Fork Dam consisted of:

1. Visual inspection of the embankment, embankment toe, and abutments.
2. Visual examination of the spillway and its components, the downstream end of the outlet pipe, and other appurtenant features.
3. Observation factors affecting the runoff potential of the drainage basin.
4. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 5 and in the photographs in Appendix C.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

Only one seepage area was observed (Photograph 10). This was located on the right abutment, approximately at the elevation of the lower paved interceptor ditch on the downstream slope. The flow was estimated to be approximately 0.5 cfs. The effect of this seepage on the overall performance of the dam is considered to be inconsequential, but it should continue to be monitored to assure that it is not increasing.

The drawings indicate six relief wells were installed at the toe of the embankment. Only three of these were found during this inspection. Of these, only one was flowing and the flow rate could not be estimated.

c. Appurtenant Structures. The spillway structures, spillway crests, channels, and plunge pools were examined for deterioration or other signs of distress and obstructions that would limit flow.

In general, the structures were found to be in good condition, except for spalling of concrete at various locations along the spillway channel. At the time of inspection, a gabion wall was under construction to prevent erosion of the sides of the pool at the end of the spillway (Photograph 6).

d. Reservoir Area. The watershed is predominantly covered with woodlands and infiltration capacity is estimated to be good. There appeared to be no major land clearing activities or other operations that would significantly increase the runoff rate of the drainage basin.

The shorelines are not considered to be susceptible to massive landslides which would affect the storage volume of the reservoir or cause overtopping of the dam by displaced water.

e. Downstream Channel. The North Fork of Bens Creek downstream from the dam flows through a 500- to 700-foot-wide valley. The bridges over the stream are shown in Photographs 11 and 12. Sketches of these bridges are included in Appendix A. A description of the downstream channel is included in Section 1.2.

3.2 Evaluation. In general, the condition of the dam is considered to be very good. A review of previous inspection reports revealed that during the period from 1933 to 1941 some seepage was reported along the right toe and on the abutment approximately 10 feet above the lower berm elevation. Two recent state inspections in 1966 and 1976 note no such seepage. On this inspection, minor seepage was observed on the right abutment (Plate 5).

Some significant spalling was observed on the upper portion of the spillway discharge channel walls. The spalling has not yet caused structural damage. However, repair measures should be taken to avoid further deterioration of the concrete.

SECTION 4 OPERATIONAL FEATURES

4.1 Procedures. Review of the design drawings and field observations indicates that there are no formal procedures for operating the dam. The operational features of the dam which may affect the safety of the dam are the spillway gates and outlet pipe valve, in case it is required to lower the reservoir.

In a state report, Report Upon the Application of the Johnstown Water Company, dated March 2, 1959, the operational features of the bascule-type spillway gates were described as follows:

"The Bascule-type gates will act as a unit, automatically or manually. They will be controlled by means of a float operated valve and compensating connection. This control will automatically position the gate to suit water level of the pond. The control will start to lower the gate when water level reaches a point 6 inches above the top of the gate and will cause the gate to be fully open when water level reaches a point 12 inches above level of top of gate in raised position. When the water level drops to 10 inches or more or less 1-1/2 inches above the top of the gate, the gate will start to raise. When the water level drops to 4 inches plus or minus 1-1/2 inches above the top of the gate, it will be raised to a full closed position. The control will have an auxiliary manual control to permit disconnecting of the automatic level control and to operate it by manual positioning of the control valve to set the gate in position from open to closed position."

The clearing of debris from the spillway as it is required and continued inspection of the facilities by the dam tender are the principal maintenance operations which would affect safety.

4.2 Maintenance of the Dam. The overall maintenance conditions of the dam appear satisfactory.

4.3 Maintenance of Operating Facilities. The blow-off pipe was operated by water company personnel and was observed to be functional.

4.4 Warning System in Effect. There is no formal warning system in effect. The dam tender resides at the site. Telephone communication is available.

4.5 Evaluation. The dam is satisfactorily maintained, and it is considered to be accessible under all weather conditions for inspection and emergency action purposes.

SECTION 5 HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. North Fork Dam has a watershed area of 10 square miles and an impounded reservoir with a surface area of 94 acres. A gated spillway 95 feet wide constitutes both the primary and emergency spillway for the impoundment. As it exists, the spillway has a design discharge capacity of 6930 cfs when the gates are fully raised. The full capacity of the spillway was computed to be 10,500 cfs with the gates lowered. Both values are with no freeboard.

b. Experience Data. As previously stated, North Fork Dam was classified to be a "large" size dam in the "high" hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass the probable maximum flood (PMF).

The adequacy of the spillway was analyzed based on the simplified procedure developed by the Baltimore District, Corps of Engineers (Appendix D). Based on this analysis procedure, it was determined that the PMF inflow hydrograph will have a peak flow of 15,000 cfs and a total volume of approximately 29,000 acre-feet. These values are greater than the spillway capacity of 10,500 cfs and the reservoir flood storage volume of 939 acre-feet, respectively. Therefore, the spillway is not capable of passing the PMF flow without overtopping. Further analysis, according to the procedure, indicated that the spillway can pass a maximum flow of approximately 73 percent of the PMF without overtopping.

c. Visual Observations. On the date of inspection, no conditions were observed that would indicate that the spillway of the dam could not operate satisfactorily in the event of a flood as long as the spillway gates are adequately maintained.

d. Overtopping Potential. As stated above, the dam will be overtopped during a flood whose magnitude exceeds 73 percent PMF.

e. Spillway Adequacy. Because the spillway cannot pass the recommended spillway design flood of PMF, it is classified to be "inadequate." However, it is not considered to be seriously inadequate because it can pass flows in excess of 50 percent PMF.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. As discussed in Section 3, the field observations did not reveal any signs of distress that would significantly affect the stability of the dam and none were reported in the past.

b. Design and Construction Data

(1) Embankment. The dam was designed at a time (1927) when limited understanding of the geotechnical behavior of earth structures existed. Consequently, the available design and construction information includes limited quantitative data to aid in the assessment of embankment stability.

(2) Appurtenant Structures. Review of the design drawings indicates that there are no apparent structural deficiencies that would significantly affect the performance of appurtenant structures.

c. Operating Records. The structural stability of the dam is not considered to be affected by the operational features of the dam.

d. Post-Construction Changes. In 1959, the crest of the dam was raised by one foot by earth fill and the bascule gates were installed at the spillway crests. Maintenance conditions of the bascule gates are satisfactory and the crest fill appears to be adequately constructed.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety. The visual observations and review of available information indicate that North Fork Dam is in good condition. It appears that the dam was constructed with reasonable care. Field observations did not reveal any signs of distress and none were reported in past inspections.

The capacity of the spillway was found to be inadequate (73 percent PMF) to pass the required PMF flow. However, since the spillway can pass flows in excess of 50 percent PMF, it is not considered to be "seriously inadequate."

b. Adequacy of Information. The available information in conjunction with visual observations and previous experience of the inspectors are considered to be sufficient to make a reasonable assessment of the dam.

c. Urgency. The recommendations listed below should be implemented as soon as practicable.

d. Necessity for Further Investigation. The condition of the dam is not considered to require further investigation at this time.

7.2 Recommendations/Remedial Measures

1. It is recommended that in periods of unusually high runoff the owner should provide around-the-clock surveillance and have contingency plans in the event of overtopping to warn the inhabitants of the flood plain.
2. It is recommended that the owner should be advised to make appropriate repairs to stop the spalling at various locations along the concrete spillway wall to prevent structural damage.
3. It is recommended that the owner should locate the six relief wells referred to in the design documents and monitor the flow from these wells.
4. It is recommended that the owner be advised that the dam and appurtenant structures

should be inspected regularly by the dam
tender and any unusual conditions should be
reported to the appropriate authorities.

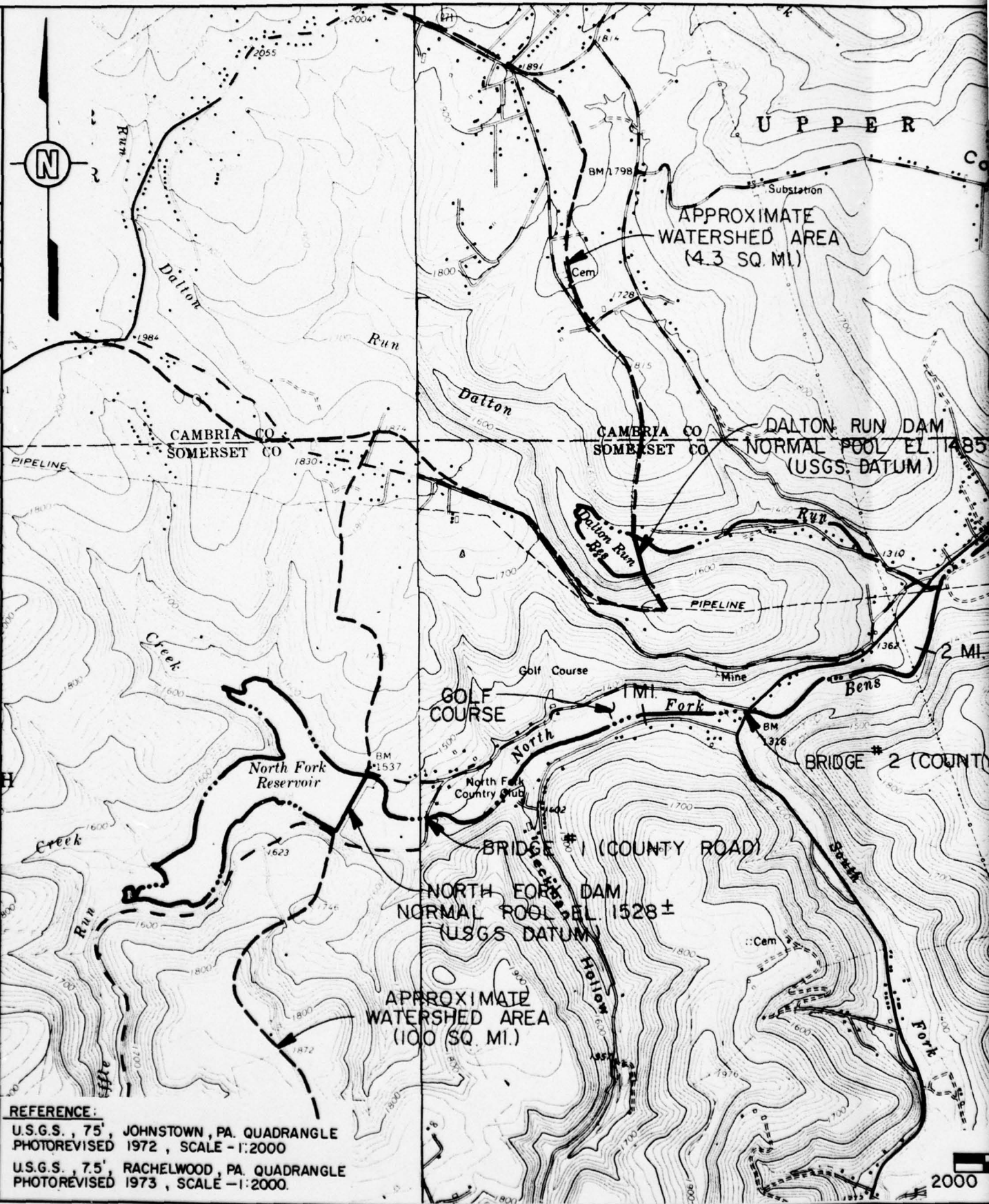
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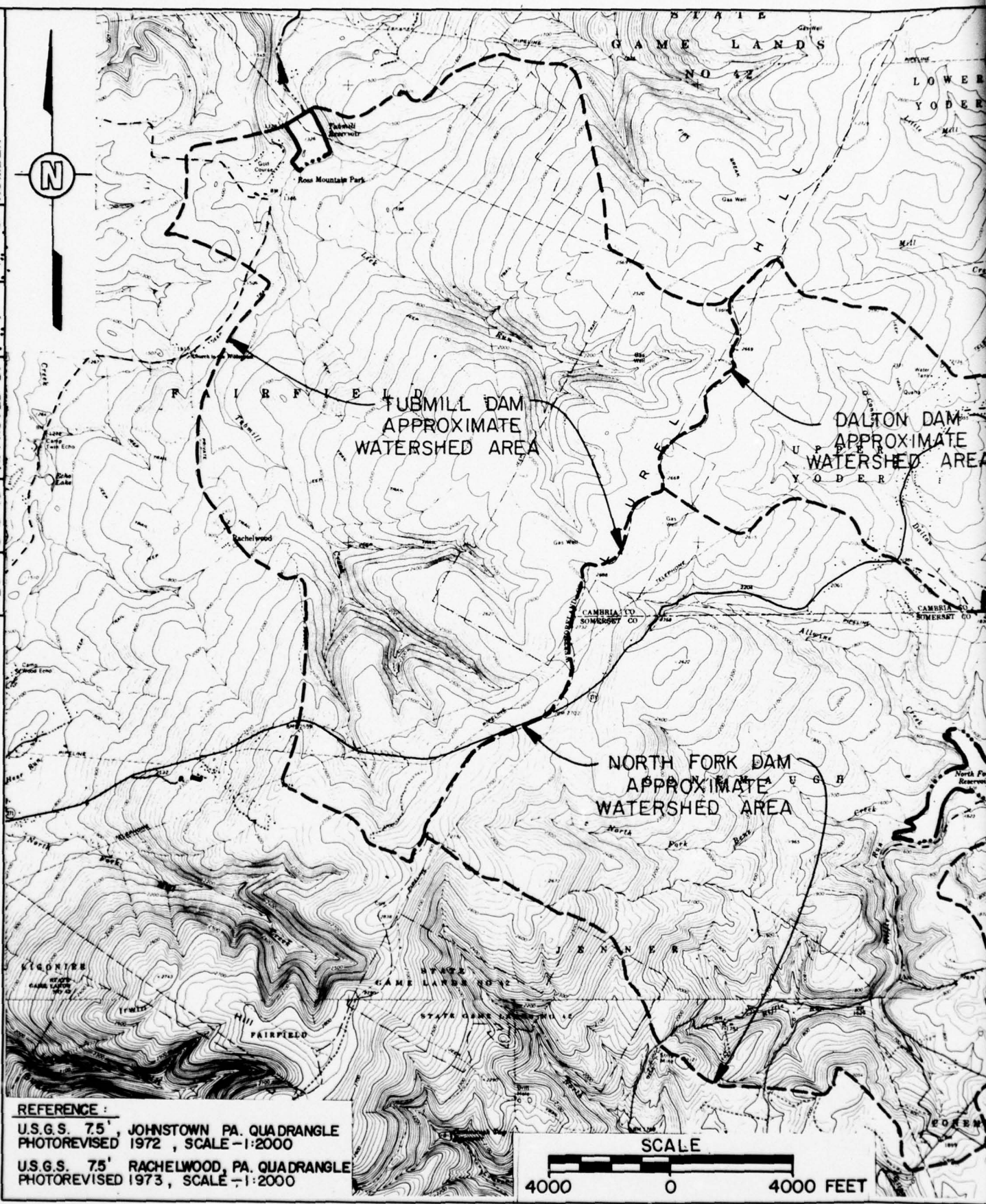




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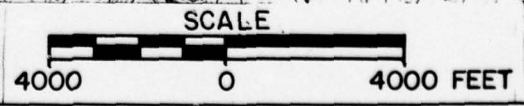
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REFERENCE :

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PHOTOREVISED 1972 , SCALE -1:2000

U.S.G.S. 7.5' RACHELWOOD, PA. QUADRANGLE
PHOTOREVISED 1973 , SCALE -1:2000



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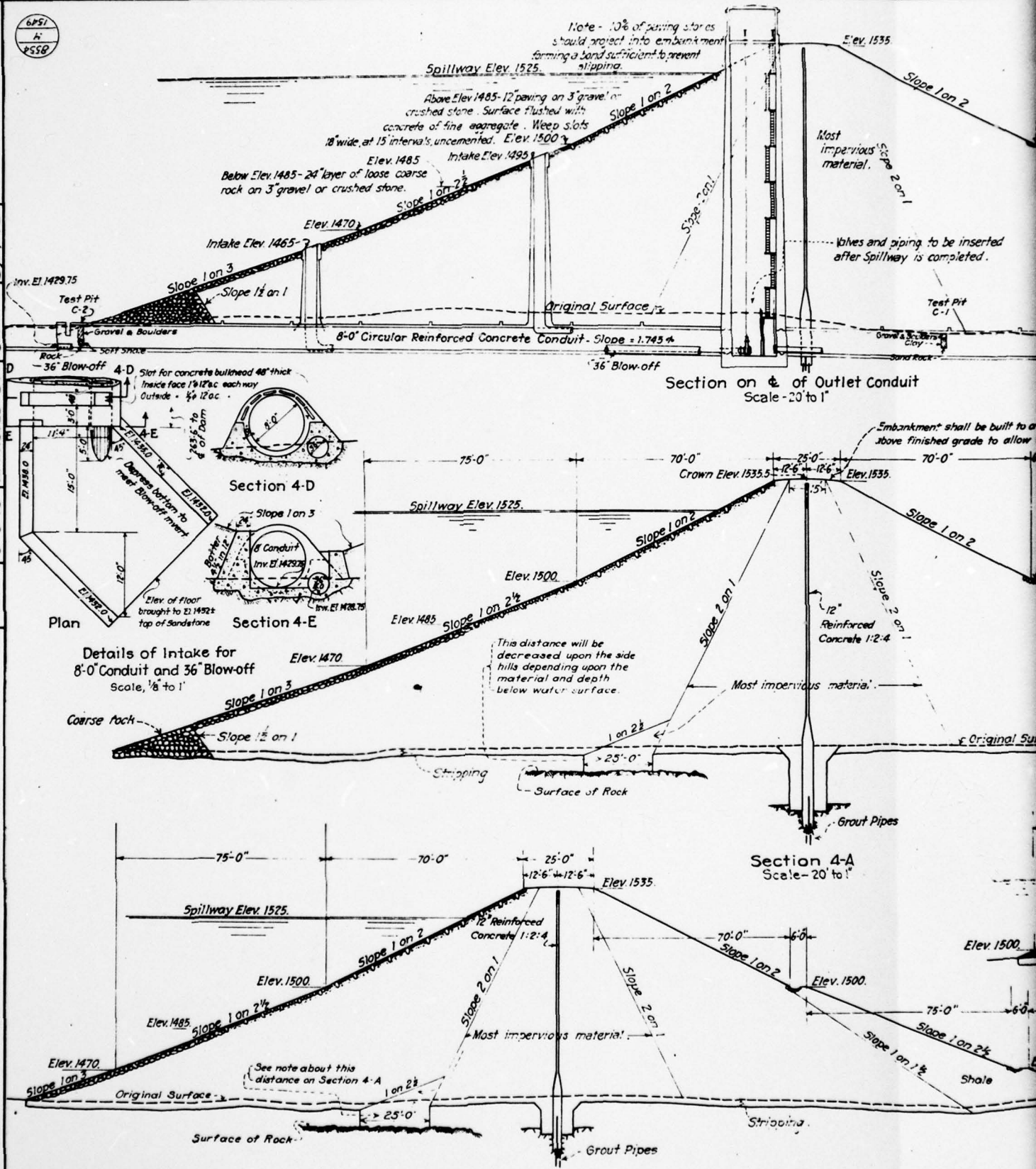
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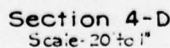
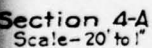
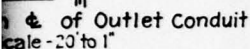
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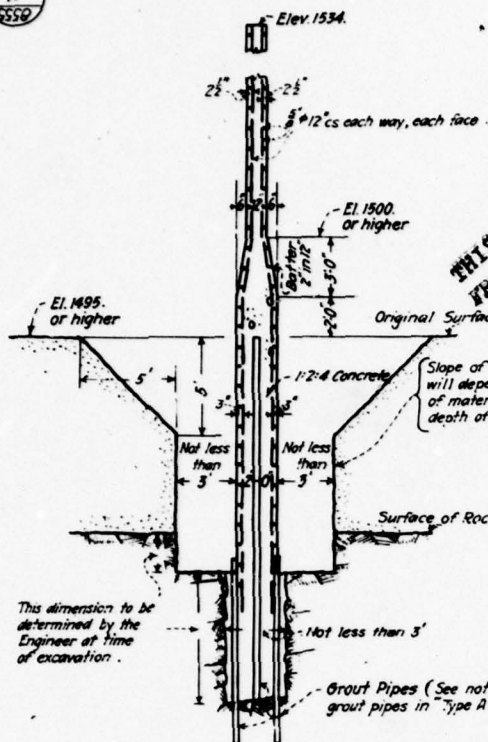
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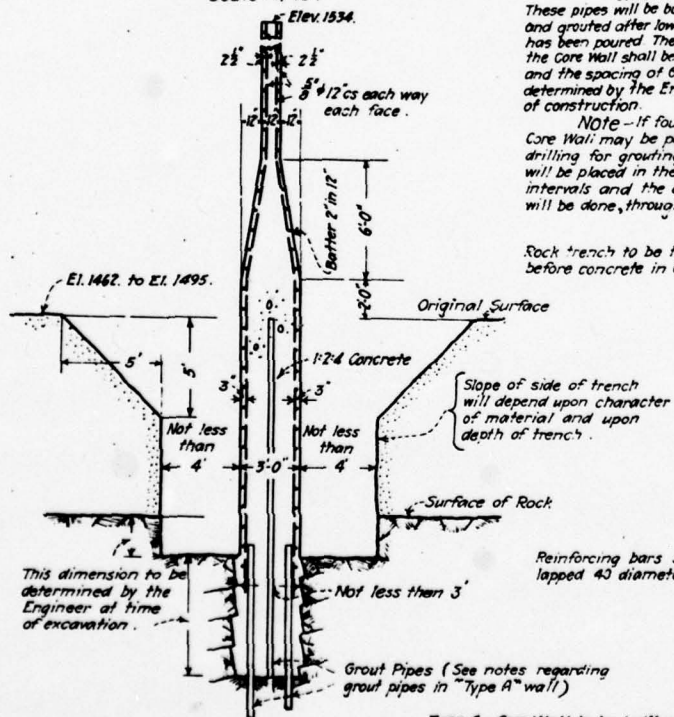


Detail of Cut-off Wall and Trenches
for 8' Conduit at 40', 90' and 140'
above & of Gate House
Scale, 1/8" to 1'

D'APPOLONIA



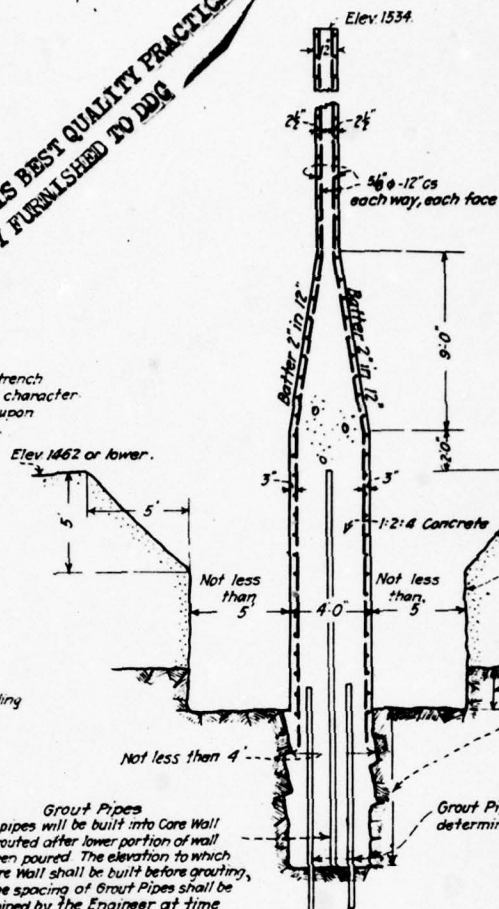
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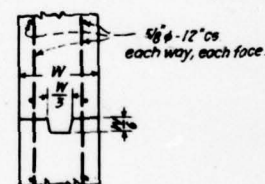
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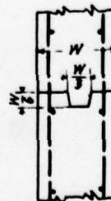
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Type - A
Scale - $\frac{1}{4}$ " to 1

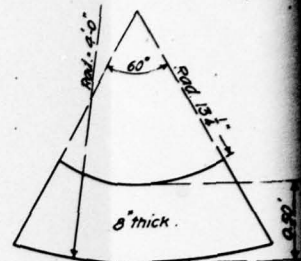


Elevation of Horizontal Joint
Scale - 1" = 6' 1"

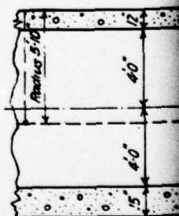


Plan of Vertical Joint
Scale-1" to 1'

Type A - Core Wall to be built where original surface is below Elev. 1462.
Type B - " " " " " " " " between Elev. 1462 and 1495.
Type C - " " " " " " " " above Elev. 1495.

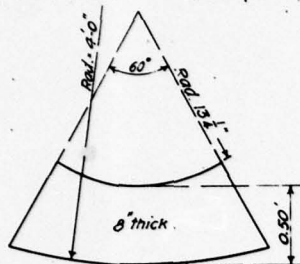


Concrete Cradle for 24 inch P
Scale - 2" to 1'

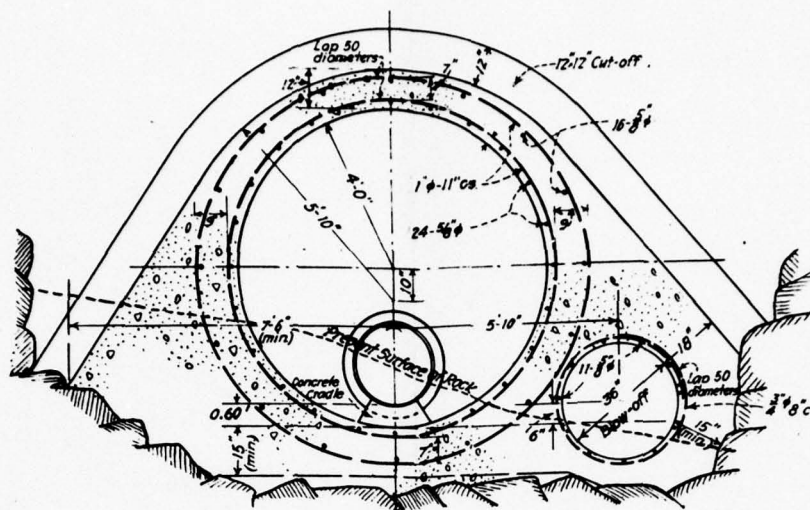


Longitudinal
Line of 8 ft
Crown Thick
at Different

Details of Core Wall.



Concrete Cradle for 24 inch Pipe.
Scale - 2" to 1'

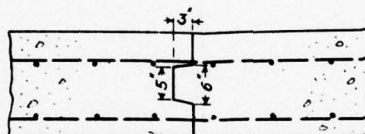


Outlet Conduit.
Section 100 ft. below ϕ of Dam.
Scale $\frac{1}{2}$ " to 1'

Note - Steel reinforcing bars shall extend through construction joints. All bars shall be lapped 50 diameters. Grooves shall be formed in the concrete at all horizontal and vertical construction joints. The distance between vertical construction joints shall not be greater than 40 feet.

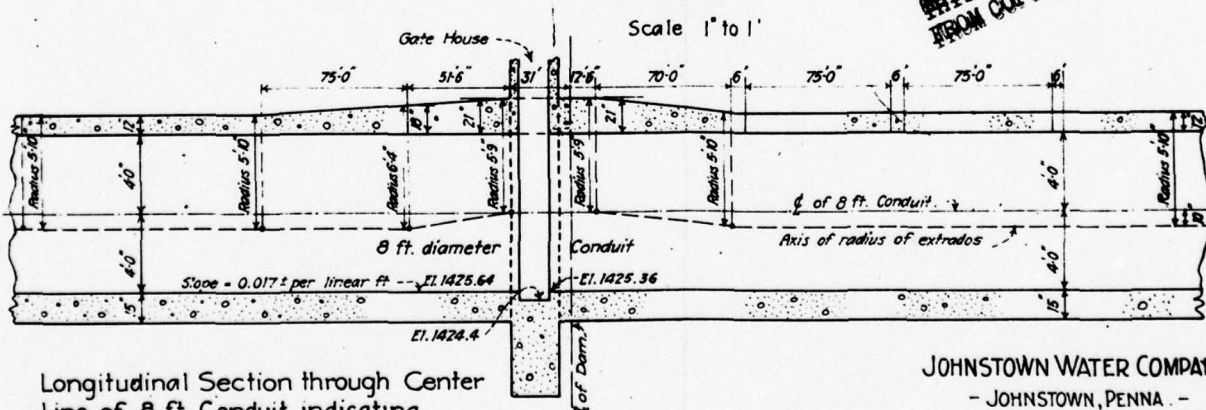
Original Surface.
Slope of side of trench will depend upon character of material and upon depth of trench.
Surface of Rock
This dimension to be determined by the Engineer at time of excavation.

Outlet Pipes staggered, to be spaced as determined by the Engineer.



Section through Vertical Joint of Conduit.
Scale 1" to 1'

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Longitudinal Section through Center Line of 8 ft. Conduit indicating Crown Thickness and Radius of Extrados at Different Points.

Scale - (Hor. 40 ft. to 1 in.
Vert. 4 ft. to 1 in.
Slope not to scale.

JOHNSTOWN WATER COMPANY
- JOHNSTOWN, PENNA. -

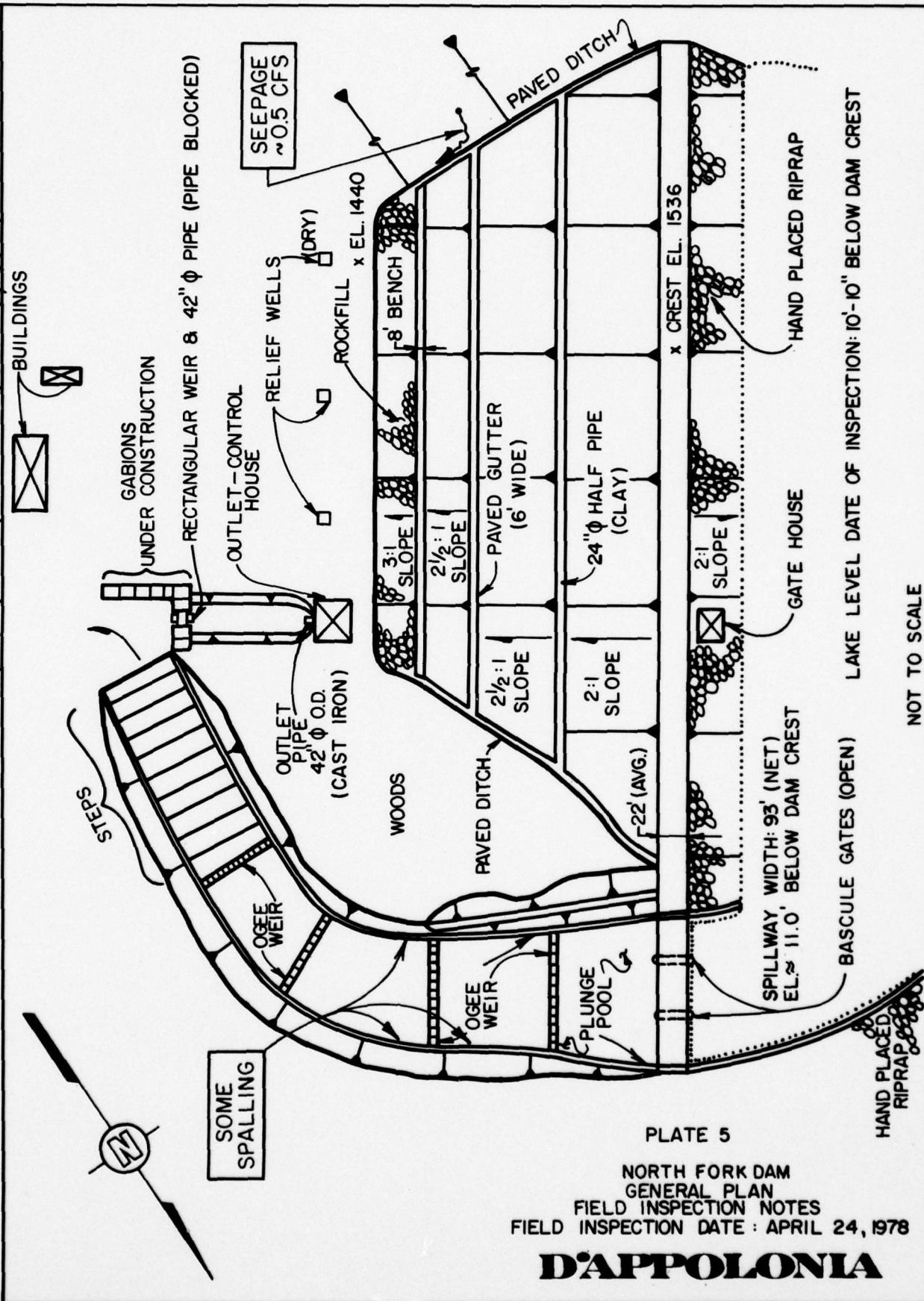
NORTH FORK RESERVOIR DETAILS OF CORE WALL AND OUTLET CONDUIT

Scale as shown. January 8, 1927.
Revised - July 20, 1927.
Metcalf & Eddy. Revised Nov 26 '27

PLATE 4

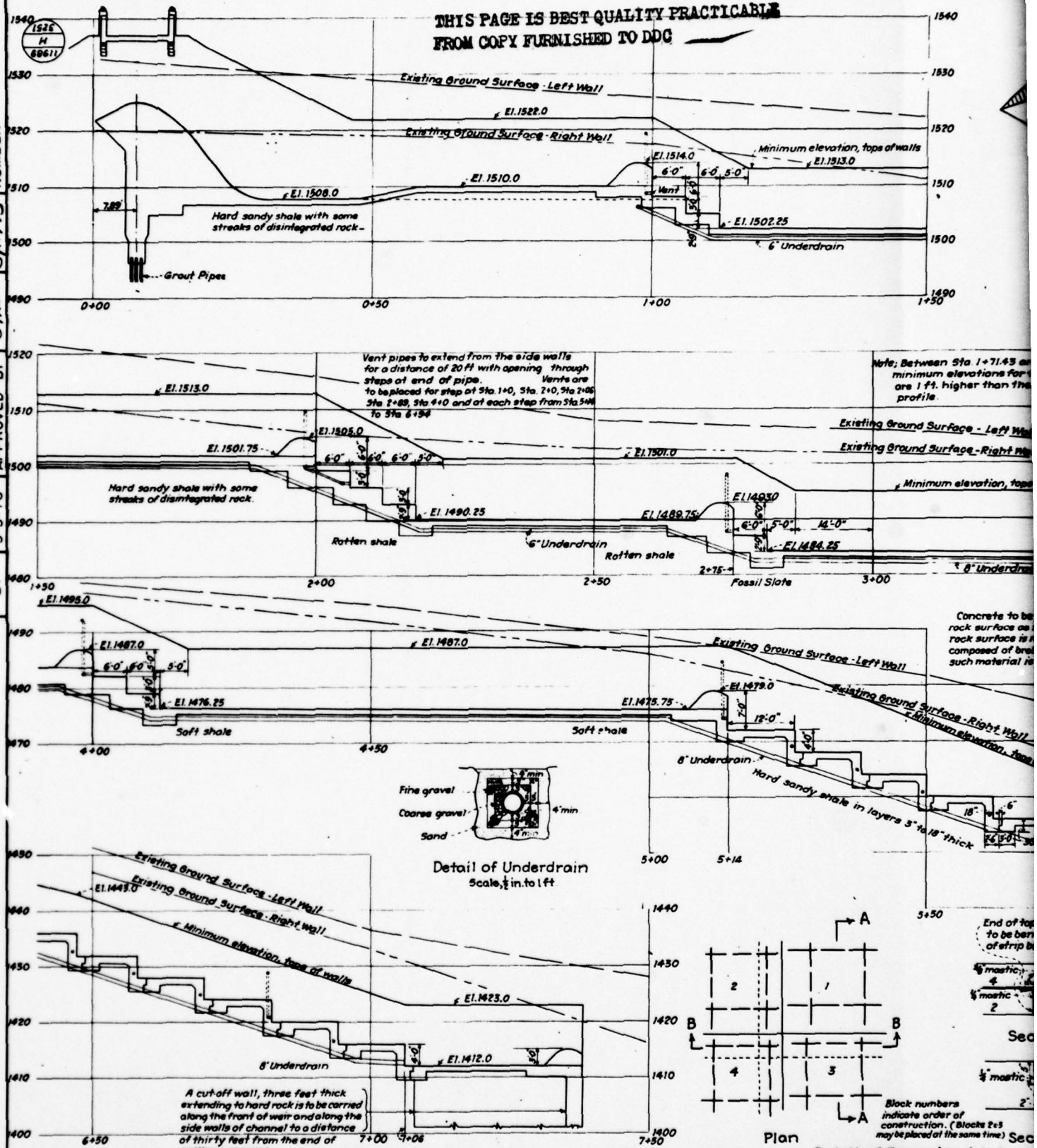
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	5-3-78	APPROVED BY	JMP		5/11/78

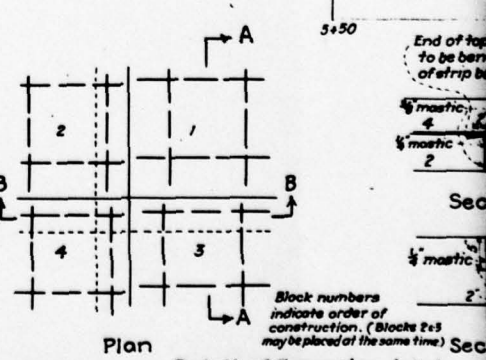


DRAWING NUMBER 78-114-B10
 CHECKED BY JMD
 APPROVED BY JMD
 DRAWN BY DJD
 5-1-78
 5-11-78
 5-3-78

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Profile
Scale, 10 ft. to 1 in.



Detail of Expansion Joint
Scale, 1 in. to 1 ft.

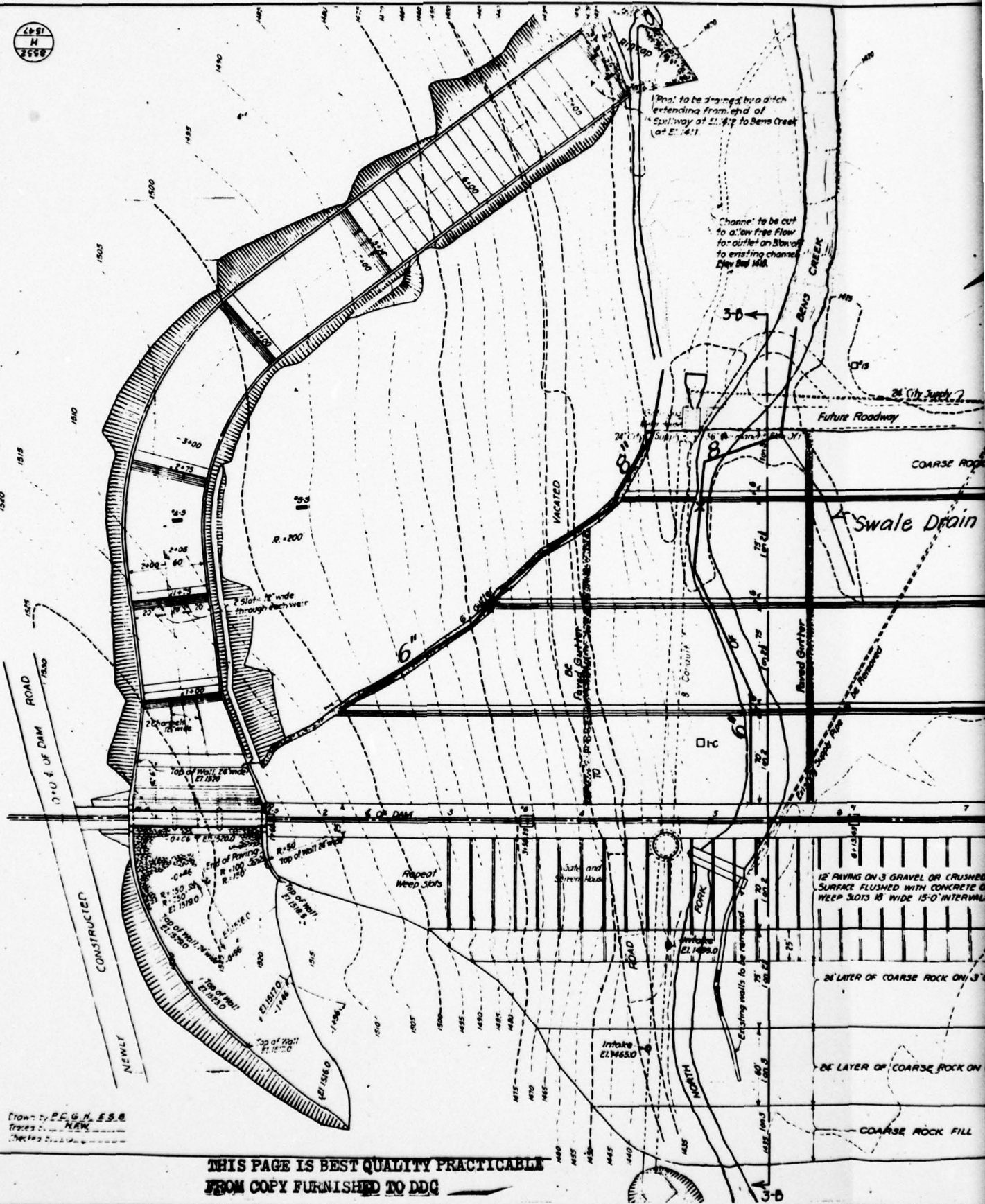
Drawn by E.S.B.
 Traced by E.S.B.
 Checked by JMD

Joints are to be placed at intervals of 15 ft. each way.

End of top to be bare of strip bit
 1/4 mastic
 1/4 mastic
 2"

Block numbers indicate order of construction. (Blocks 2 & 3 may be placed at the same time)
 2"

DRAWN BY	D.J.D.	CHECKED BY B.E.	S-11-78	DRAWING NUMBER	78-114-B11



Drawn by P.E. G.H. E.S.B.
Traces by P.H.K.
Checked by P.H.K.

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JOHNSTOWN WATER COMPANY

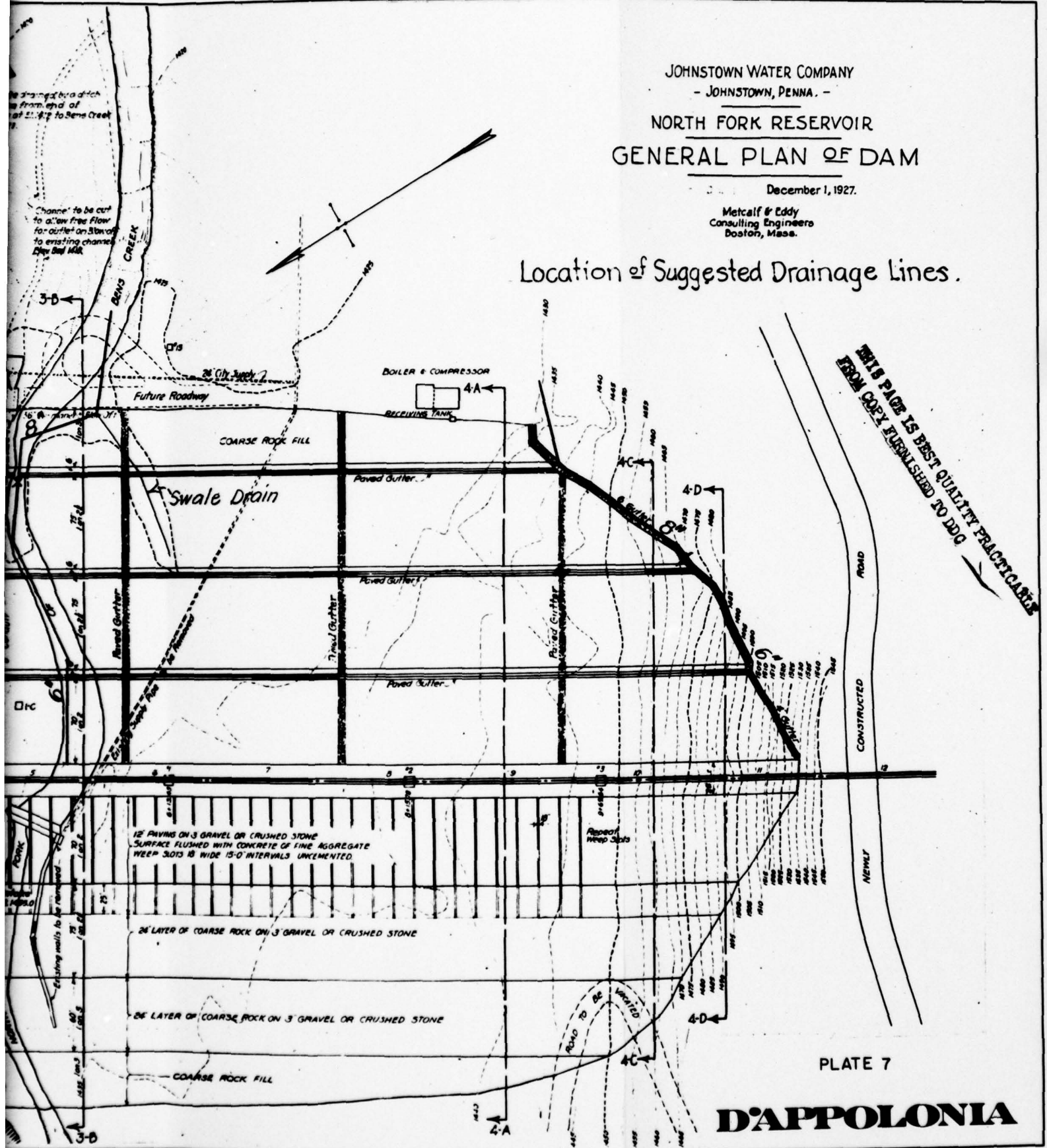
- JOHNSTOWN, PENNA. -

NORTH FORK RESERVOIR GENERAL PLAN OF DAM

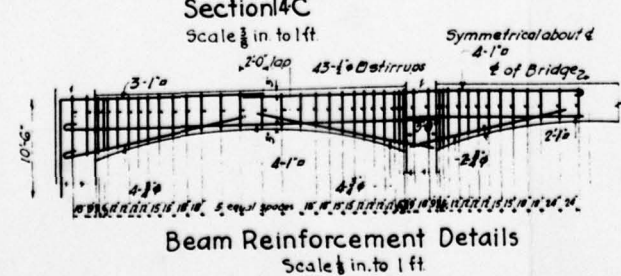
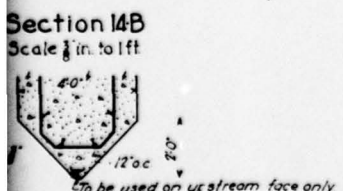
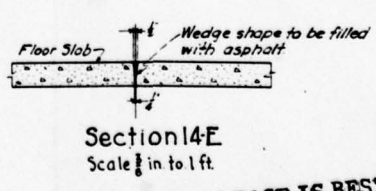
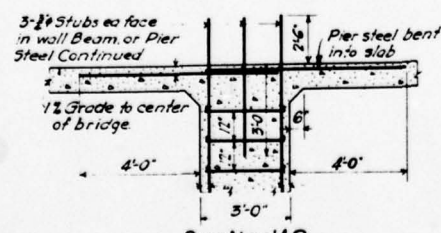
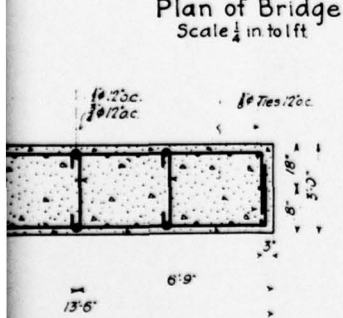
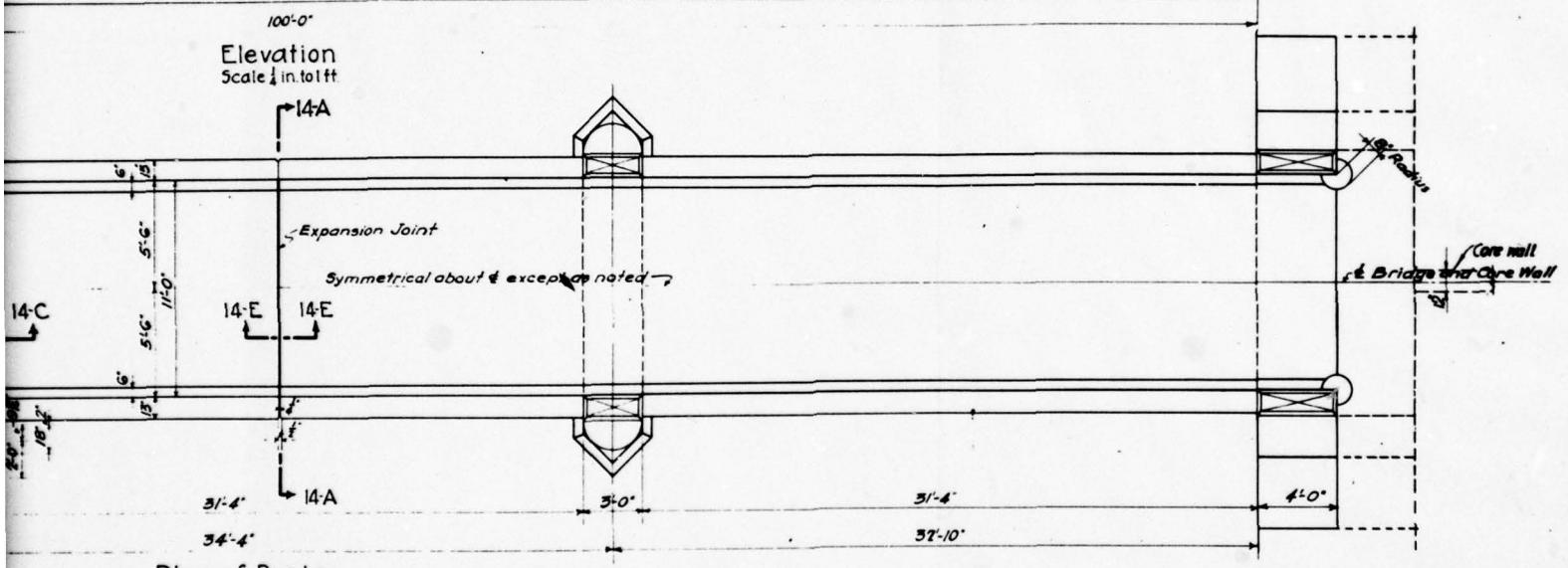
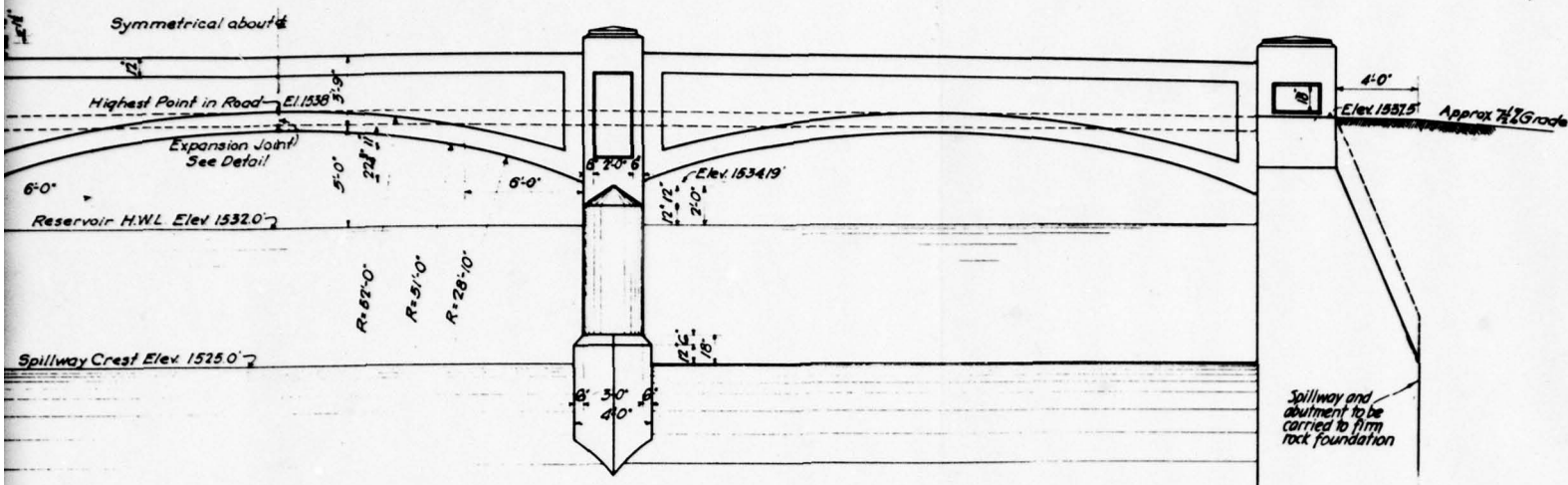
December 1, 1927.

Metcalf & Eddy
Consulting Engineers
Boston, Mass.

Location of Suggested Drainage Lines.



D'APPOLONIA



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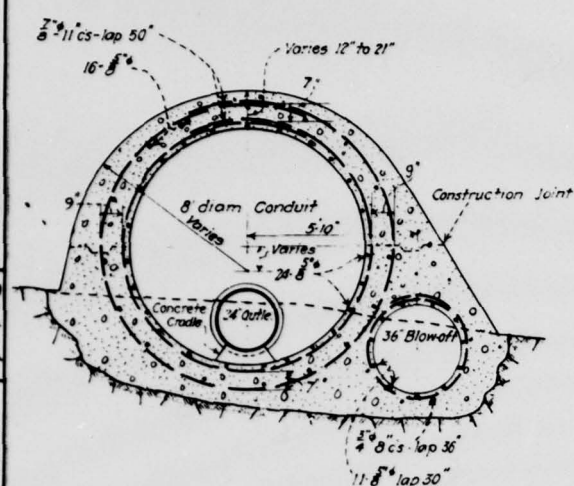
JOHNSTOWN WATER COMPANY
- JOHNSTOWN, PENNA. -
NORTH FORK RESERVOIR
SPILLWAY BRIDGE

Scale as shown November 26, 1927.

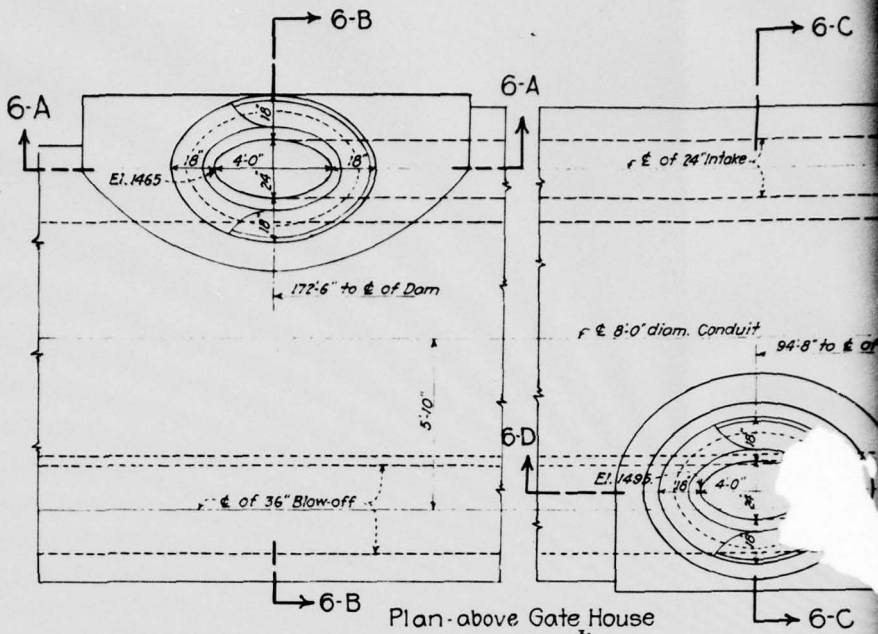
PLATE 8

D'APPOLONIA

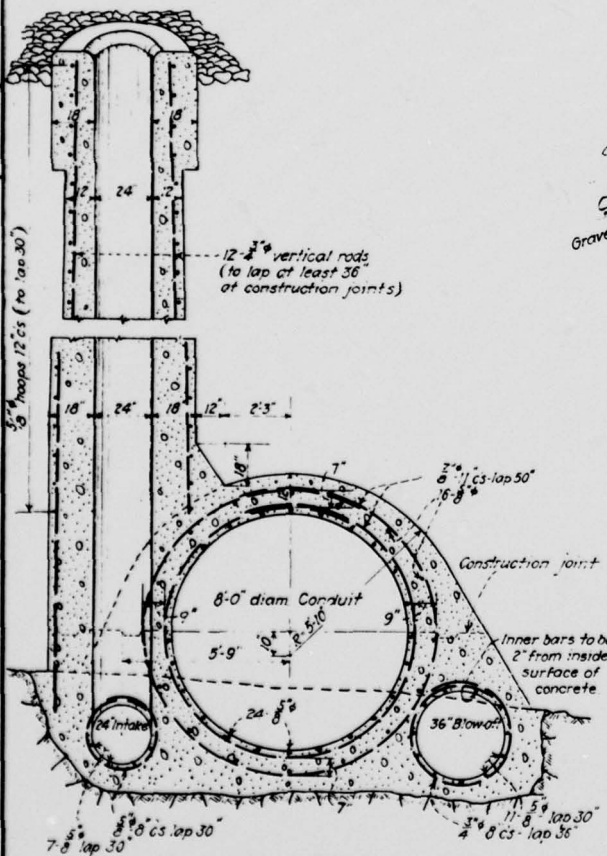
DRAWN BY D.J.D. 5-3-78
 CHECKED BY B.E. 5-11-78
 APPROVED BY J.H.P. 5/11/78
 DRAWING NUMBER 78-114-B13



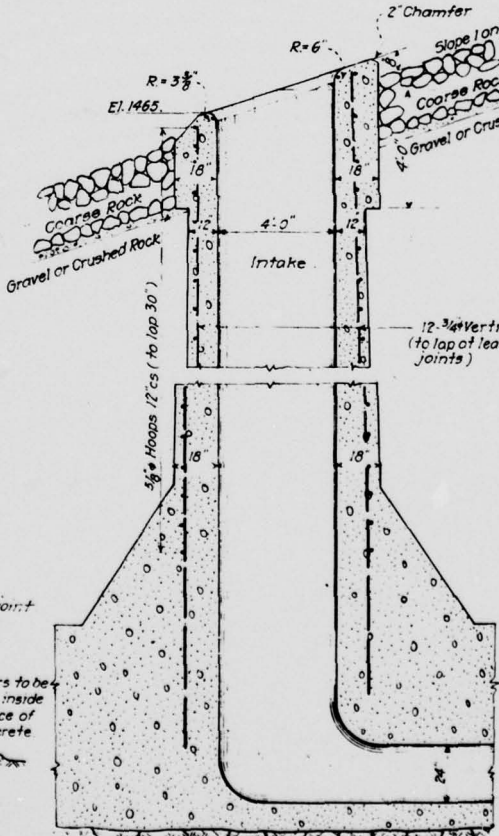
Typical Section below Gate House
 Scale - 3/8" to 1'



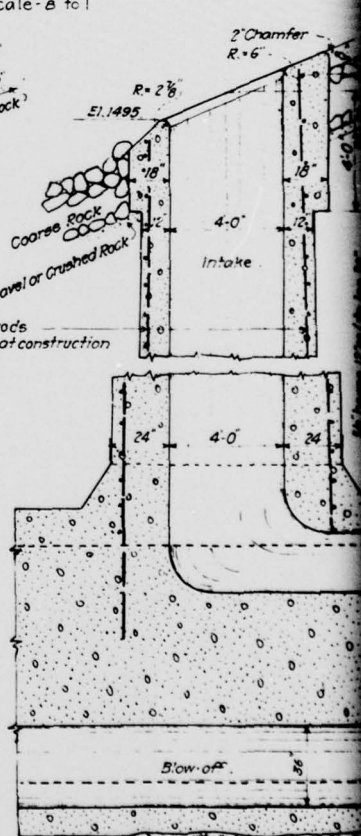
Plan above Gate House
 Scale - 3/8" to 1'



Section 6-B
 Scale - 3/8" to 1'

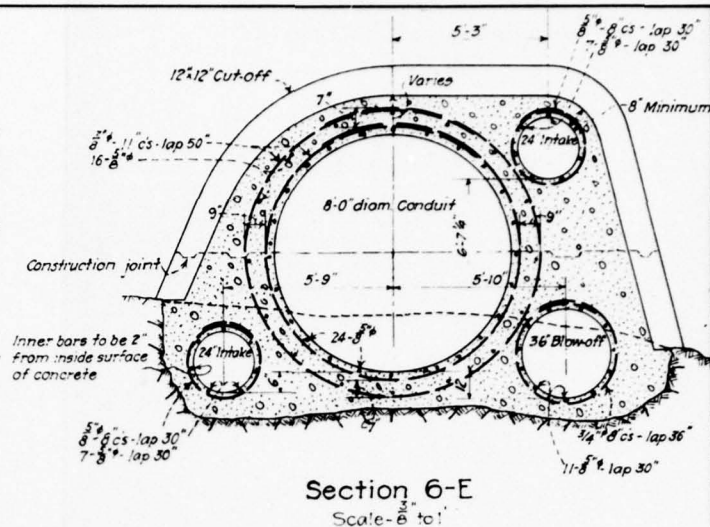
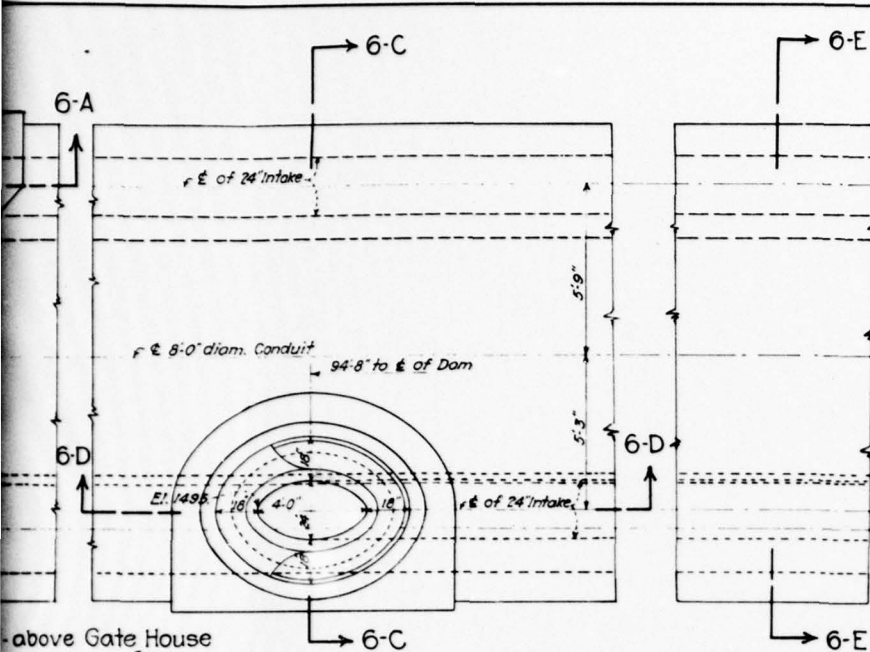


Section 6-A
 Scale - 3/8" to 1'

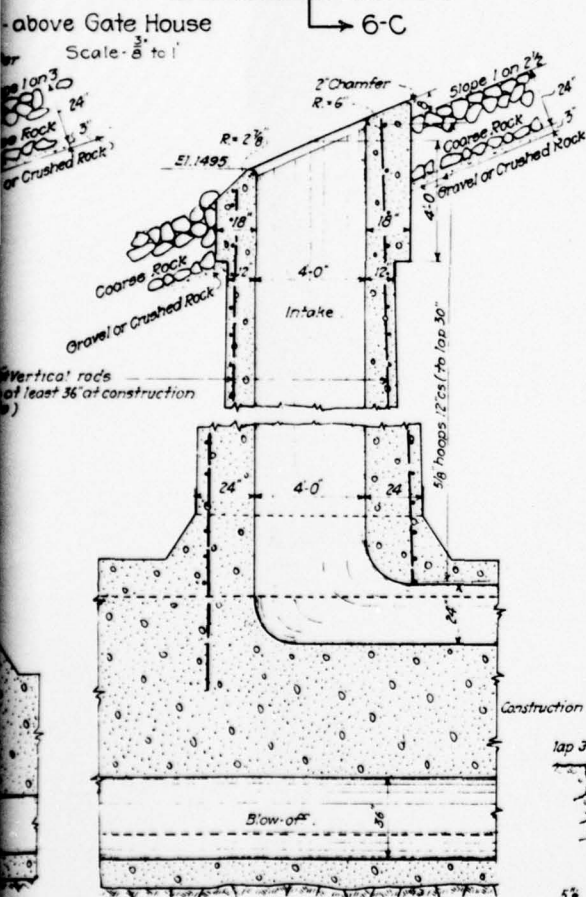


Section 6-D
 Scale - 3/8" to 1'

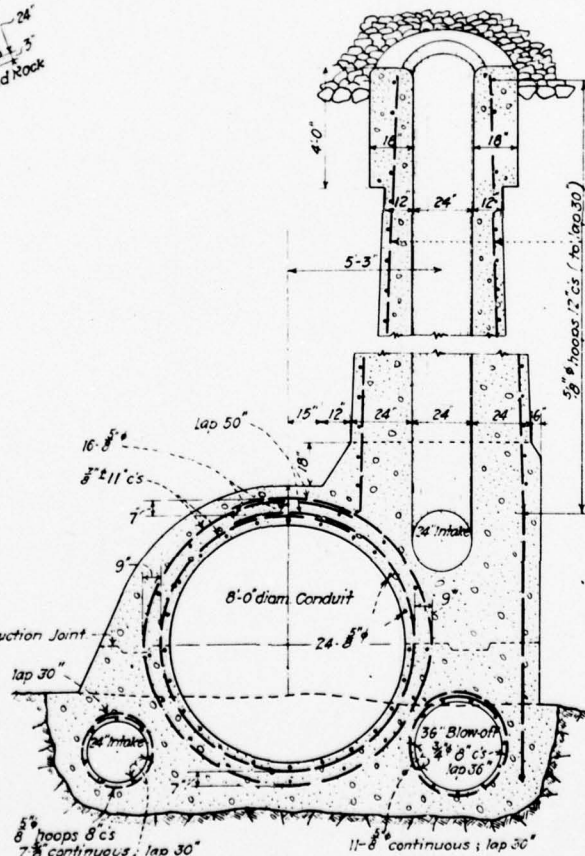
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Note: The elevations indicated for the grade of the 8ft conduit are subject to change, being dependent upon the character of the underlying rock. It is the intention to excavate the rock to the extent necessary to provide a solid foundation for the conduit.



Section 6-D
Scale 1/8" = 1'



Section 6-C
Scale 1/8" = 1'

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For section of conduit below core wall and transition diagram, see sheet #5.

JOHNSTOWN WATER COMPANY - JOHNSTOWN, PENNA - NORTH FORK RESERVOIR INTAKE DETAILS AND CONDUIT SECTIONS

Scale as shown November 24, 1927

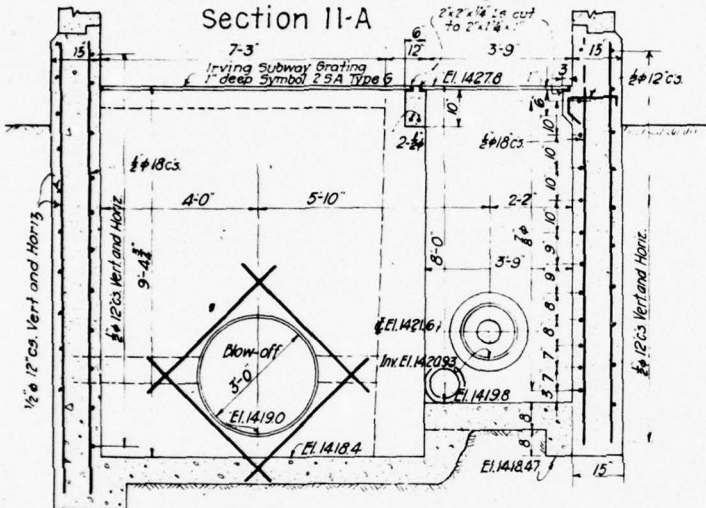
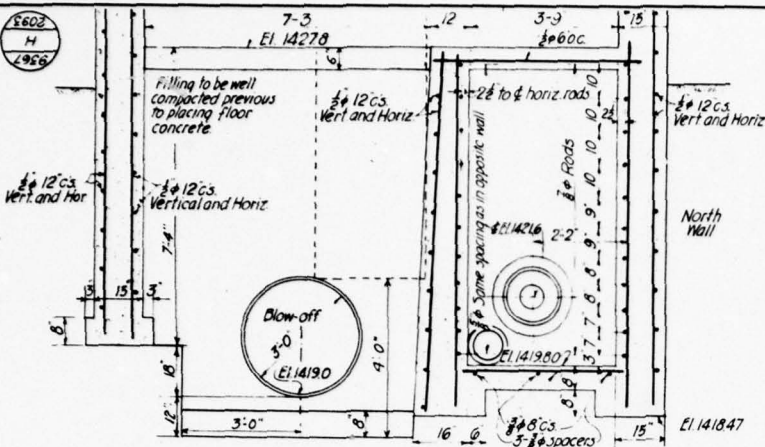
Metcalf & Eddy
Engineers
Boston, Mass.

PLATE 9

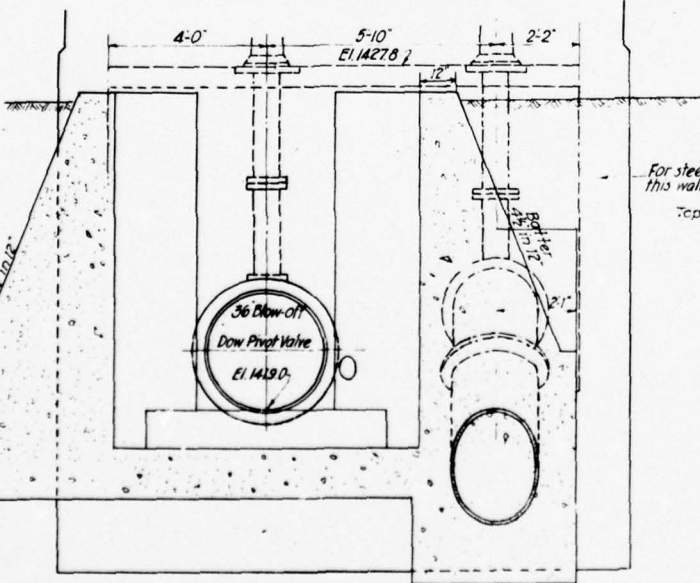
D'APPOLONIA

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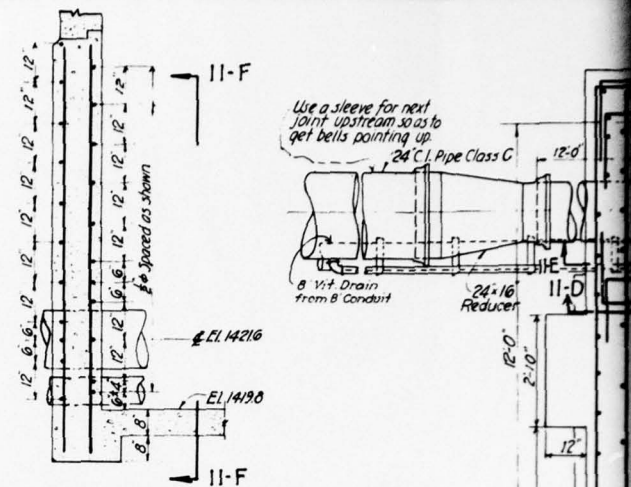
Section II-B



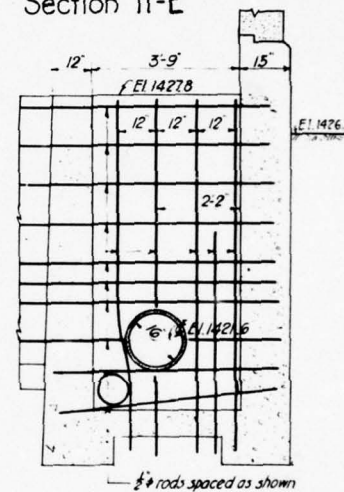
Sectional Elevation II-C

Drawn by F.S.B. E.S.B.
Traced by H.E.M. E.S.B.
Checked by J.C.S.

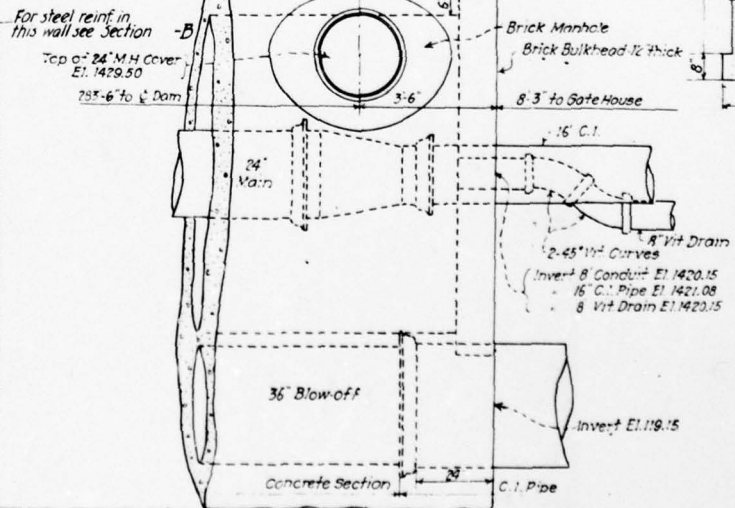
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Section II-E

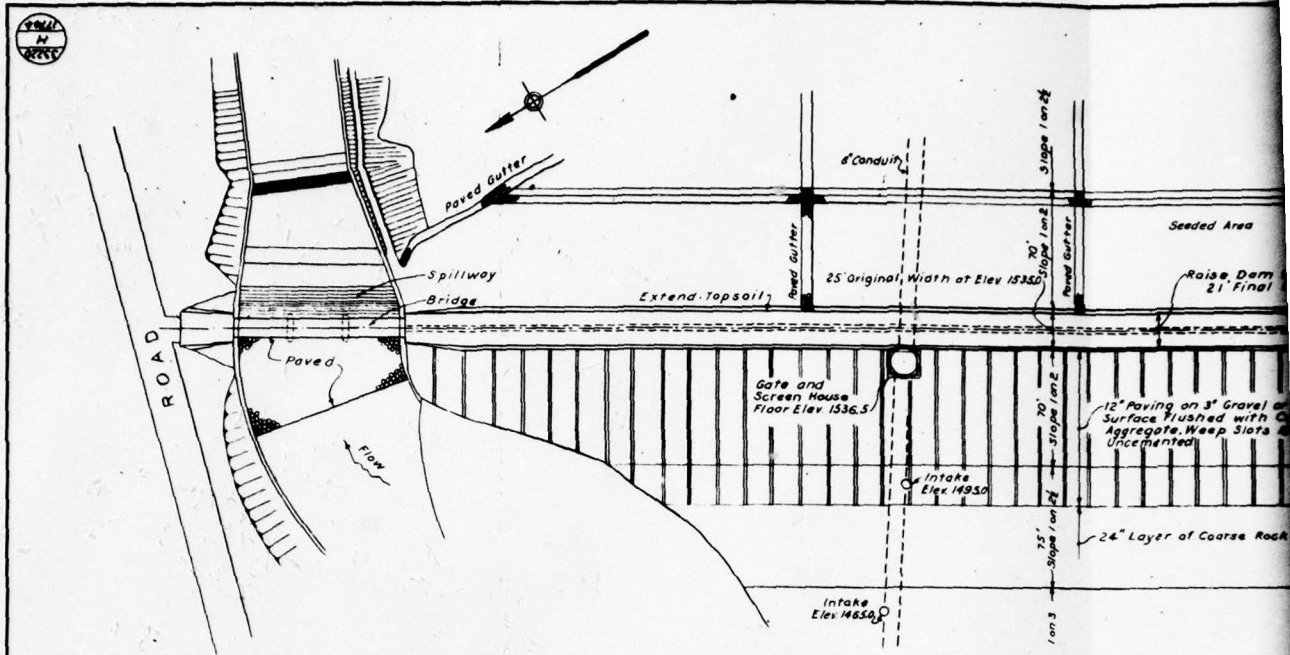


Sectional Elevation II-F



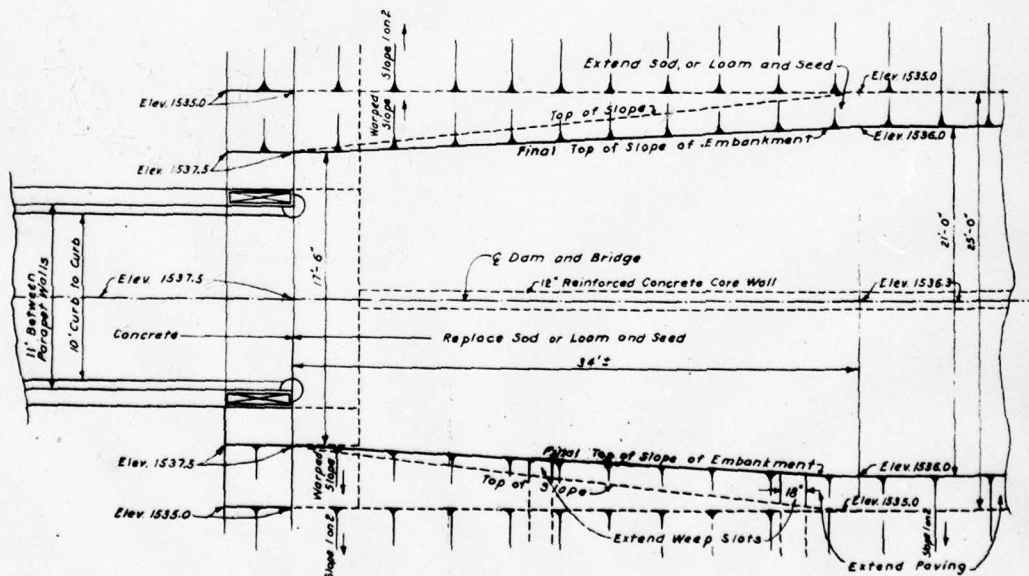
Plan of End of 8'-0" Conduit

DRAWN BY D.J.D. CHECKED BY BE S-11-78 DRAWING 78-114-B15
 5-3-78 APPROVED BY JHP S-11-78 NUMBER



PLAN OF DAM AT TOP OF EMBANKMENT

SCALE: 1"=40'



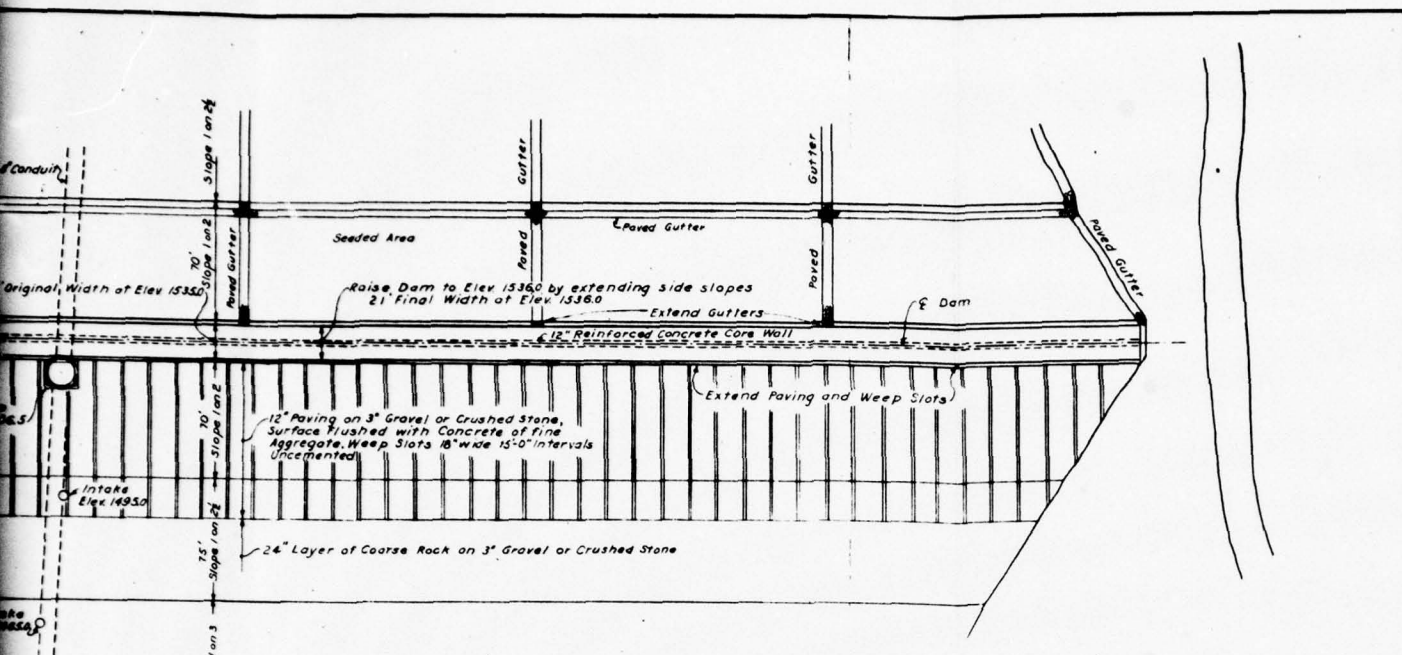
BRIDGE APPROACH (TYPICAL)

PLAN

SCALE: 1"=10'

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 CHECKED BY H.B.
 APPROVED BY G.E.T.

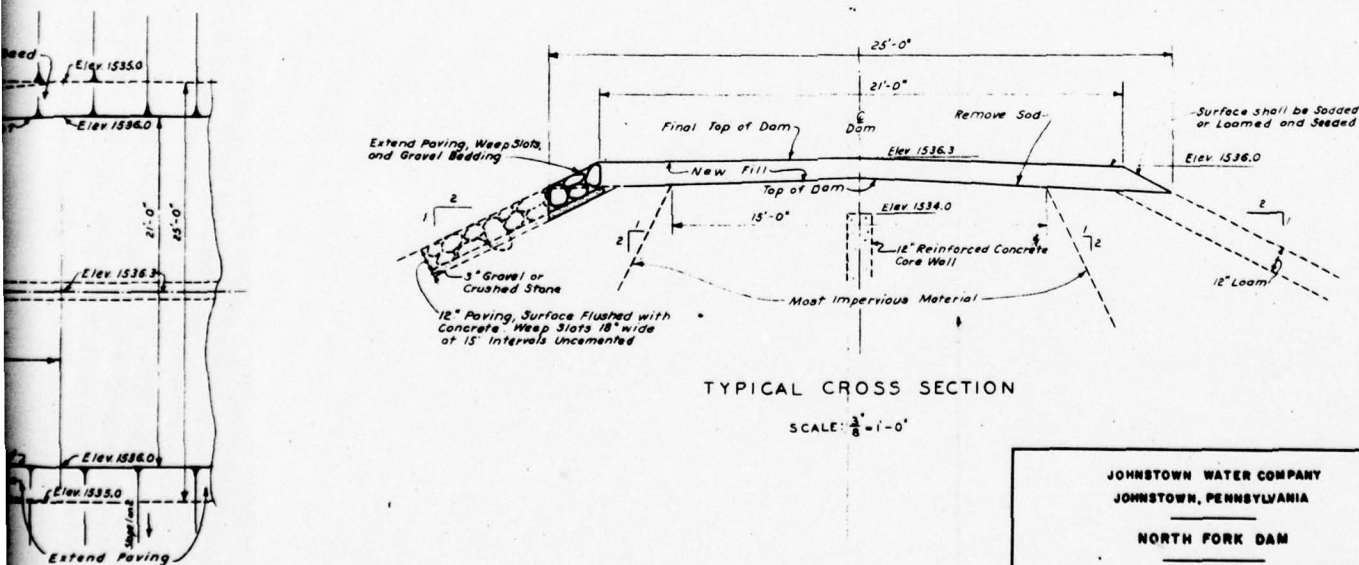
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PLAN OF DAM AT TOP OF EMBANKMENT

SCALE: 1"=40'

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TYPICAL CROSS SECTION

SCALE: $\frac{1}{8}$ "=1'-0"

JOHNSTOWN WATER COMPANY
JOHNSTOWN, PENNSYLVANIA

NORTH FORK DAM

ADDITION TO DAM CREST

SCALE: AS SHOWN JAN 18 1938

APPROVED	
FOR NITCALF & SONS, ENGINEERS	DATE
<i>[Signature]</i>	1-21-38
RES. PROP. JOHNSTOWN, PA.	DATE

NITCALF & SONS
ENGINEERS
BOSTON, MASS.



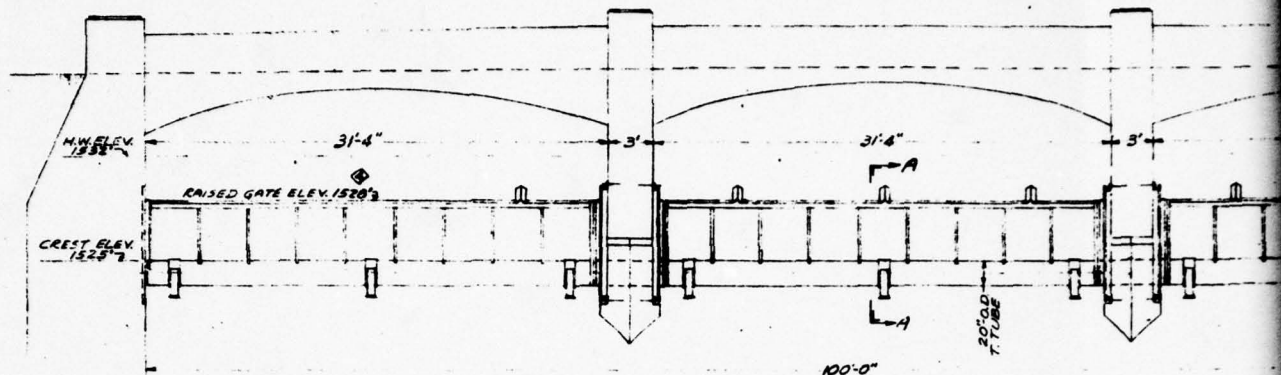
PLATE II

D'APPOLONIA

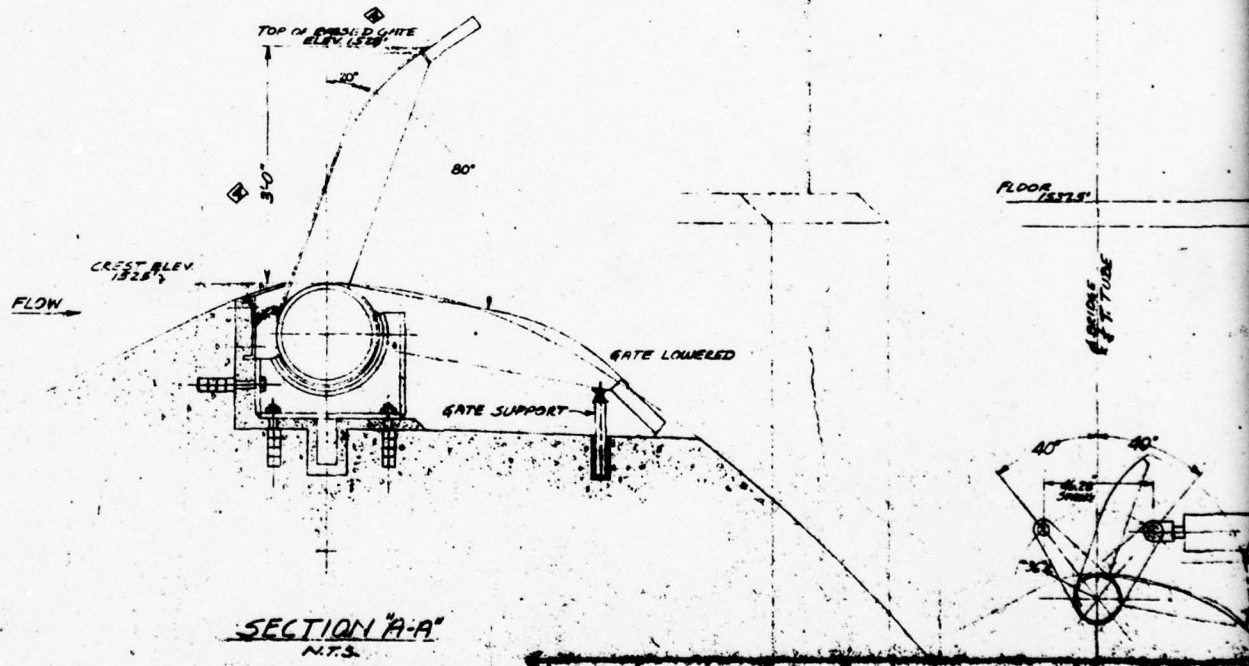
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				5-11-78		

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ELEVATION-LOOKING UP STREAM
100'-0"
16'-1'-0"



SECTION "A-A"
N.T.S.

CABLE

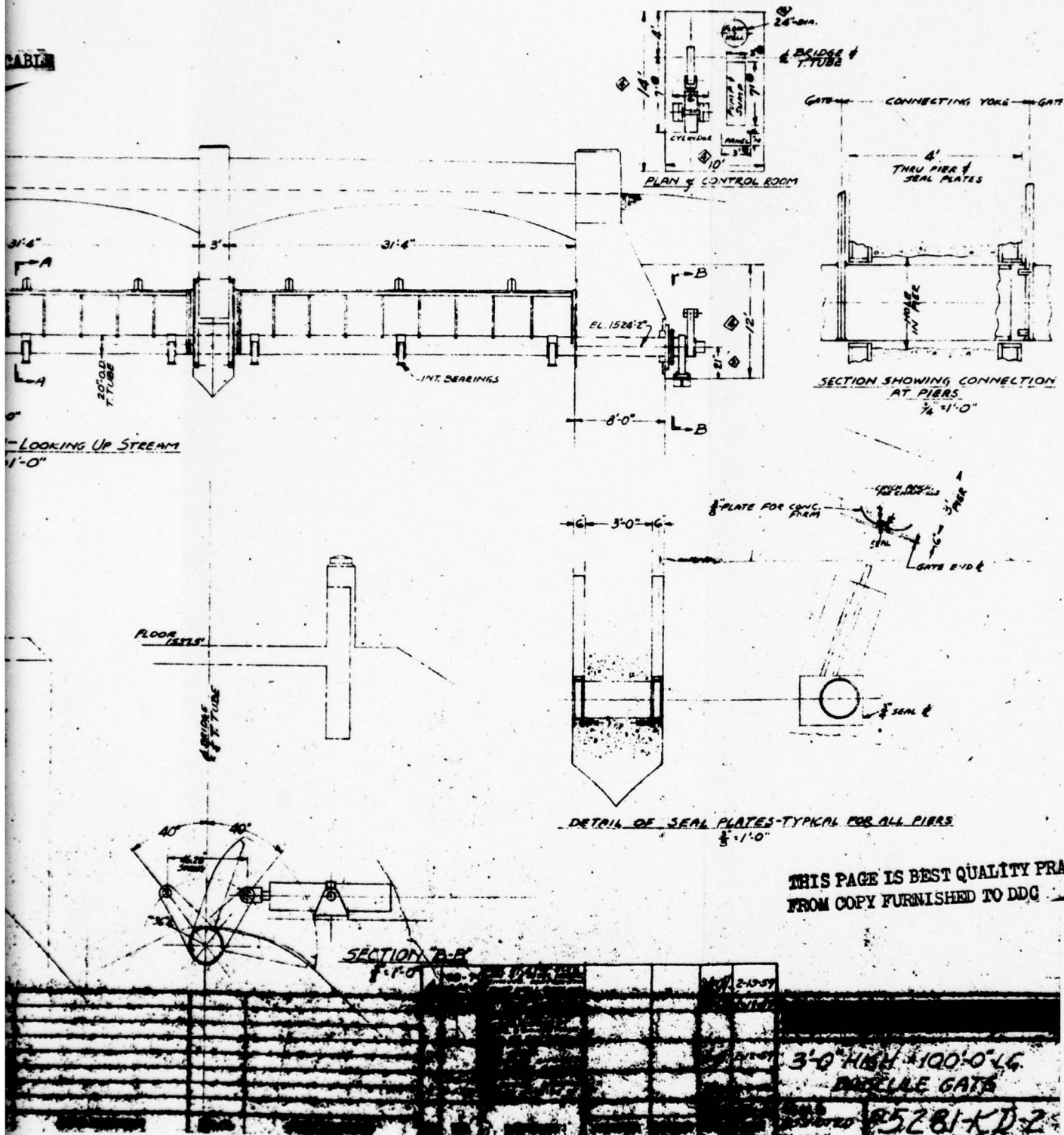


PLATE 12

D'APPOLONIA

2

APPENDIX A
CHECKLIST, VISUAL INSPECTION
PHASE I

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM NORTH FORK DAM COUNTY SOMERSET STATE PA. ID# NDS:234, DER:56-53

TYPE OF DAM EARTH FILL HAZARD CATEGORY HIGH

DATE(S) INSPECTION 4-24 & 25-1978 WEATHER CLOUDY 4/24 TEMPERATURE 40~50's
SUNNY 4/25

POOL ELEVATION AT TIME OF INSPECTION ~1525'-2" M.S.L. TAILWATER AT TIME OF INSPECTION ~1410 M.S.L.

INSPECTION PERSONNEL:

<u>BILGIN EREL</u>	<u>REVIEW INSPECTION BY:</u>	<u>ELIO D'APPOLONIA.</u>
<u>WAH-TAK CHAN</u>	<u>(5-4-78)</u>	<u>LAWRENCE ANDERSEN</u>
<u></u>	<u></u>	<u>JAMES POELLOT</u>

BILGIN EREL RECORDER

VISUAL INSPECTION
 PHASE I
 EMBANKMENT

NAME OF DAM NORTH FORK DAM
 ID# NDS:234 DER:56-53

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE	
SLOUCHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	NONE	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	NO NOTICEABLE SETTLEMENT OR MISALIGNMENT	
RIPRAP FAILURES	NONE - MINOR IRREGULARITIES IN HAND-PLACED RIPRAP.	IRREGULARITIES ARE CONSIDERED INCONSEQUENTIAL.

VISUAL INSPECTION
 PHASE I
 EMBANKMENT

NAME OF DAM NORTH FORK DAM
 ID# NDS:234, DER: 56-53

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	NO VISUAL SIGNS OF DISTRESS MINOR SEEPAGE ON RIGHT ABUTMENT (LOOKING DOWNSTREAM) SEE PLATE-5 FOR LOCATION.	SEEPAGE NOT SIGNIFICANT.
ANY NOTICEABLE SEEPAGE	NO SEEPAGE ON THE EMBANKMENT OR AT THE VICINITY OF THE TOE.	
STAGE GAGE AND RECORDER	NONE FOUND.	
DRAINS	3- PRESSURE RELIEF WELLS ABOUT 50-75' FROM TOE. (THESE WELLS WERE NOT FOUND IN ORIGINAL DRAWINGS) SEE PLATE-5 FOR APPROX LOCATION OF WELLS LOCATED DURING INSPECTION.	2 OF THE 3 WELLS WERE DISCHARGING ~ 10 TO 20 GPM, EACH. ROUGH ESTIMATE ONLY. NO MEASURING DEVICE INSTALLED.

VISUAL INSPECTION
 PHASE I
 CONCRETE/MASONRY DAMS

NAME OF DAM NORTH FORK DAM
 ID# NDS: 234 DER: SC-53

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	(EARTH-FILL DAM) ∴ N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

VISUAL INSPECTION
PHASE I
CONCRETE/MASONRY DAMS

NAME OF DAM NORTH FORK DAM
ID# NDS: 234 DER: 56-53

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	EARTH-FILL DAM N/A.	
STRUCTURAL CRACKING	N/A.	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A.	
MONOLITH JOINTS	N/A.	
CONSTRUCTION JOINTS STAFF GAGE OF RECORDER:	N/A	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

NAME OF DAM NORTH FORK DAM
ID# NDS: 234 DER: 56-53

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	NONE (ONLY OUTLET END IS VISIBLE)	
INTAKE STRUCTURE	INTAKE STRUCTURE SUBMERGED, NOT VISIBLE.	
OUTLET STRUCTURE	IMPACT BLOCK BASIN - GOOD CONDITION.	
OUTLET CHANNEL	MORTARED RIPRAP LINED, GOOD CONDITION	BEYOND RIPRAP LINED CHANNEL GABIONS UNDER CONSTRUCTION.
EMERGENCY GATE	REPORTED OPERATIONAL ON FIRST VISIT. LATER OPERATED BY WATER COMPANY PERSONNEL ON 5/15/78 AND OBSERVED TO BE FUNCTIONAL.	

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

NAME OF DAM NORTH FORK DAM

ID# NDS:234 DER:56-53

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	(NO UNGATED SPILLWAY AT THE DAM) N/A.	
APPROACH CHANNEL	N/A.	
DISCHARGE CHANNEL	N/A.	
BRIDGE AND PIERS	N/A.	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

NAME OF DAM NORTH FORK DAM
ID# NDS:234 DER: 56-S3

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	BASCULE TYPE, 3 FT HIGH GATES ON AN OGEE WEIR. WEIR IS IN GOOD CONDITION.	
APPROACH CHANNEL	NO DEBRIS - GOOD CONDITION	
DISCHARGE CHANNEL	4 OGEE WEIRS IN SPILLWAY CHANNEL GOOD CONDITION. SIGNIFICANT SPALLING ON CONCRETE SIDE WALLS. (AT ISOLATED LOCATION)	SPALLING CONDITION SHOULD BE CORRECTED.
BRIDGE PIERS	2 BRIDGE PIERS ON SPILLWAY CONTROL WEIR. PIER ARE ADEQUATLY STREAM-LINED. ARE NOT CONSIDERED TO BE OBSTRUCTION TO FLOW.	
GATES AND OPERATION EQUIPMENT	3 FT HIGH BASCULE TYPE GATES IN THREE SECTIONS BETWEEN THE BRIDGE PIERS. HYDRAULICLY OPERATED. (AUTOMATIC OR MANUAL)	

VISUAL INSPECTION
 PHASE I
 INSTRUMENTATION

NAME OF DAM NORTH FORK DAM
 ID# NDS: 234 DER: 56-53

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE	
OBSERVATION WELLS	3- PRESSURE RELIEF WELLS AS SHOWN IN PLATE -5	
WEIRS	NONE	
PIEZOMETERS	NONE	
OTHER	NONE	

VISUAL INSPECTION
 PHASE I
 RESERVOIR
 NAME OF DAM NORTH FORK DAM
 ID# NDS:234 DER:56-S3

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	GENTLE TO STEEP. WOODED.	
SEDIMENTATION	LAKE IS CLEAR NO INDICATION OF HIGH SEDIMENT LOAD IN FEEDING STREAMS.	

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VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

NAME OF DAM NORTH FORK DAM
ID# NDS: 234 DER: S6-53

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	TYPICAL STREAM CHANNEL, NO MAJOR OBSTRUCTIONS.	SEE APPENDIX-A FOR SKETCHES OF BRIDGES OVER THE STREAM.
SLOPES	NO MAJOR EROSION.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	IS HOMES IN FIRST 1/2 MILE REACH OF FLOOD PLAIN (NUMEROUS OTHER ALONG BENS CREEK). GOLF COURSE. COUNTY HIGHWAY CROSSING. POPULATION OVER 50.	SEE PLATE I: VICINITY AND FLOOD PLAIN MAP.

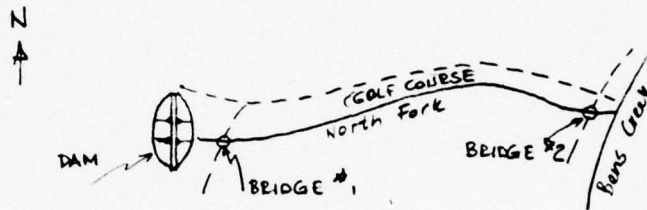
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D'AMPOLONA

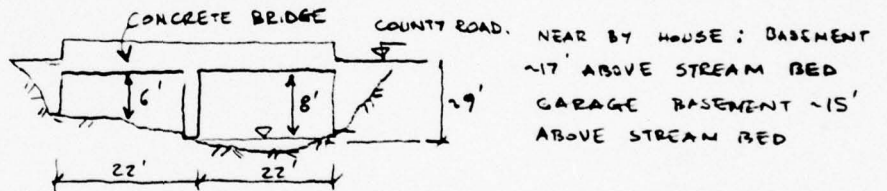
CONSULTING ENGINEERS, INC

By BE Date 4/25/78 Subject NORTH FORK DAM DER ID 56-53 Sheet No. 1 of 1
 Chkd. By WTL Date 4/25/78 FIELD INSPECTION SKETCH Proj. No. 78-114-02

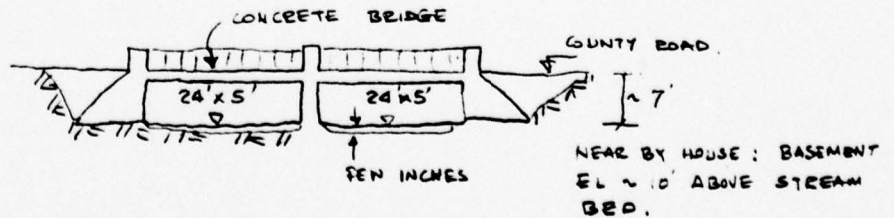
STREAM CROSS SECTIONS @ BRIDGE LOCATIONS



BRIDGE #1



BRIDGE NO-2



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APPENDIX B
CHECKLIST, ENGINEERING DATA,
DESIGN, CONSTRUCTION, OPERATION
PHASE I

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM NORTH FORK DAM
ID# NDS: 234 DER: 56-53

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ITEM	REMARKS
AS-BUILT DRAWINGS	NOT AVAILABLE - (DESIGN DRAWINGS ATTACHED)
REGIONAL VICINITY MAP	SEE PLATE - 1
CONSTRUCTION HISTORY	WELL DOCUMENTED IN PA-DER FILES, IN NUMEROUS CORRESPONDENCE & REPORTS. SUMMARY: CONSTRUCTION PERMIT DATE: JUNE 8, 1927 CONSTRUCTION COMPLETED: ~ DECEMBER, 1932 CONSTRUCTION PERMIT TO ADD GATES: MARCH 20, 1959
TYPICAL SECTIONS OF DAM	SEE PLATE - 3
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	SEE PLATES 4 THROUGH 13 UNKNOWN.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM NORTH FORK DAM
ID# NDS:234 DER:56-53

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NOT AVAILABLE
DESIGN REPORTS	NOT AVAILABLE
GEOLOGY REPORTS	NOT AVAILABLE
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	NOT AVAILABLE
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	NOT AVAILABLE

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM NORTH FORK DAM
ID# NDS: 234 DER: 56-53

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	NUMEROUS PA-DER INSPECTIONS FROM 1933 TO PRESENT,
BORROW SOURCES	NOT KNOWN.
MONITORING SYSTEMS	NONE.
MODIFICATIONS	BASCULE GATES WERE INSTALLED TO SPILLWAY ON 1959
HIGH POOL RECORDS	NOT AVAILABLE.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM NORTH FORK DAM
ID# NDS:234 DER: S6-53

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE FOUND.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	NONE REPORTED.
MAINTENANCE OPERATION RECORDS	NOT AVAILABLE.
SPILLWAY PLAN SECTIONS DETAILS	SEE PLATE - 6
OPERATING EQUIPMENT PLANS AND DETAILS	SEE PLATE 12 (FURTHER DETAILS ARE AVAILABLE IN STATE FILES)

NAME OF DAM NORTH FORK DAM

ID# NDS: 234, DER: 56-53

CHECKLIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: _____

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): _____

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): _____

ELEVATION MAXIMUM DESIGN POOL: 1528 (USGS DATUM) (BASCULE GATES RAISED)

ELEVATION TOP DAM: 1536 (USGS DATUM)

CREST:

- a. Elevation 1536
- b. Type EARTH (GRASS)
- c. Width 25'-0 (AS DESIGNED) ~ 22'-0 (AVG, MEASURED)
- d. Length 1200 FT (AS DESIGNED)
- e. Location Spillover NO VISIBLE LOW SPOTS ∴ ENTIRE LENGTH.
- f. Number and Type of Gates THREE BASCULE GATES (93' TOTAL LENGTH)

OUTLET WORKS:

- a. Type 36" ϕ BLOW-OFF, + (2-24" ϕ SUPPLY LINES)
- b. Location NEAR LEFT ABUTMENT THROUGH THE EMBANKMENT
- c. Entrance Inverts 1429.75' (AS DESIGNED) (BLOW-OFF)
- d. Exit Inverts 1419' (AS DESIGNED) (BLOW-OFF)
- e. Emergency Draindown Facilities 36" ϕ BLOW-OFF

HYDROMETEOROLOGICAL GAGES:

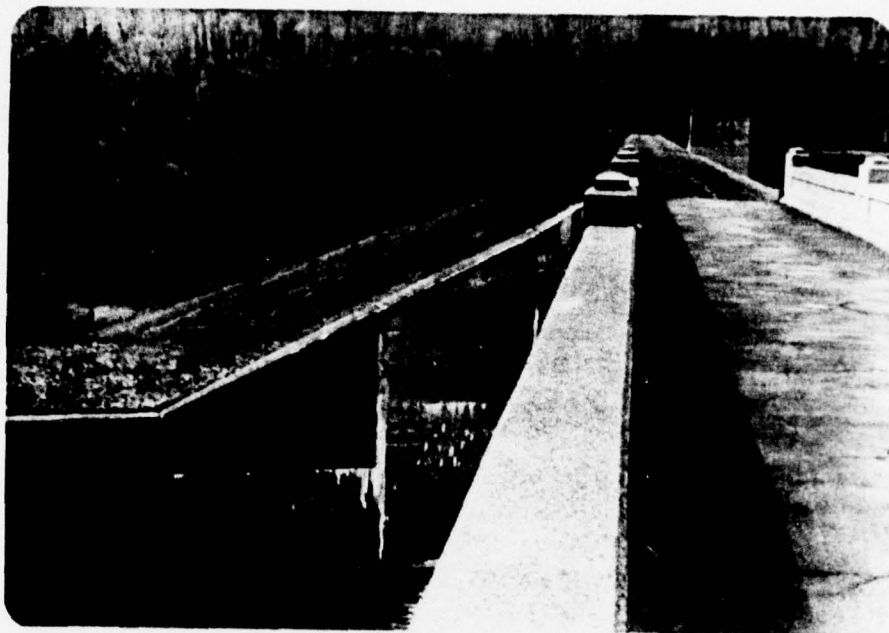
- a. Type NONE FOUND
- b. Location N/A
- c. Records N/A.

MAXIMUM NONDAMAGING DISCHARGE: 11,000 CFS \approx MAX SPILLWAY DISCHARGE

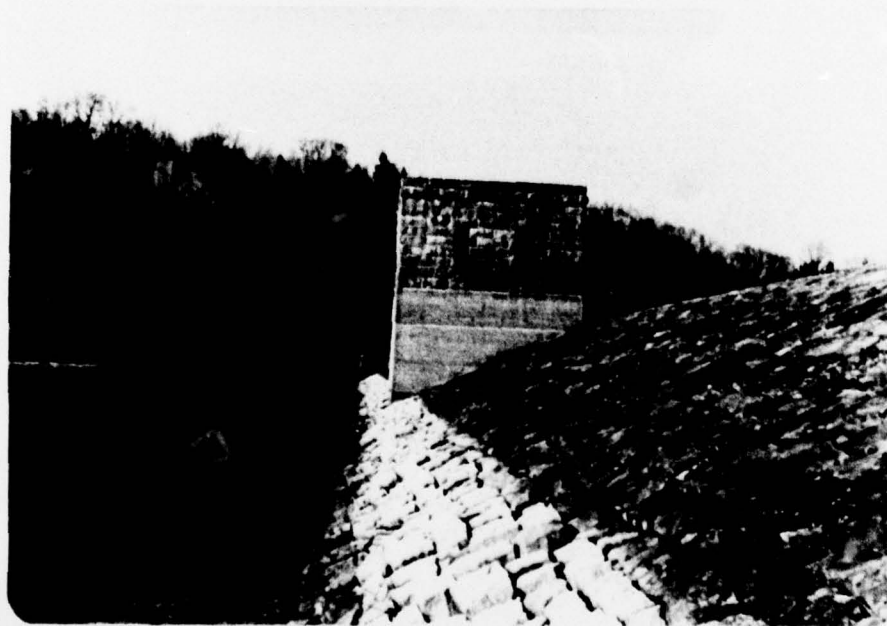
APPENDIX C
PHOTOGRAPHS

LIST OF PHOTOGRAPHS
NORTH FORK DAM
NDS I.D. NO. 234
APRIL 24 AND 25, 1978

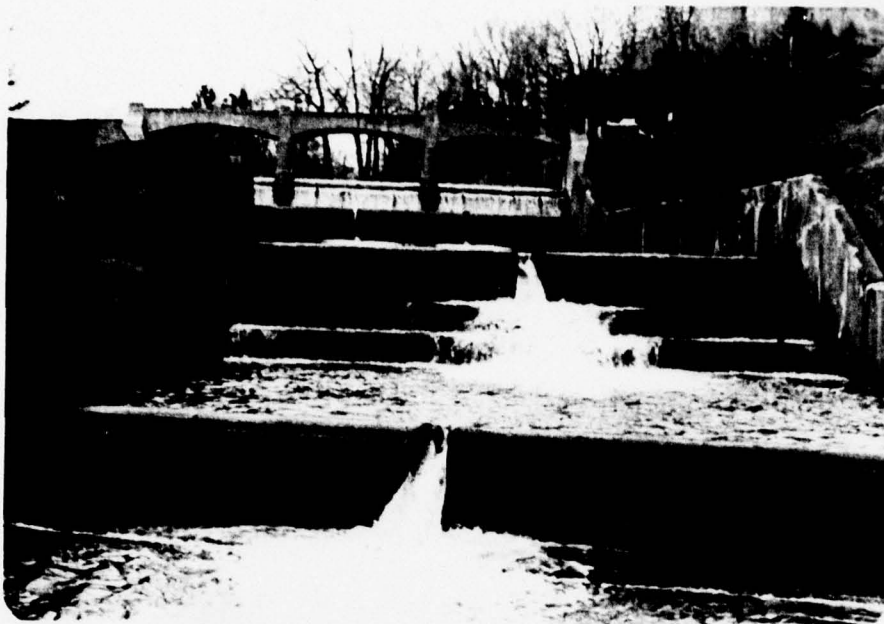
<u>PHOTOGRAPH NO.</u>	<u>DESCRIPTION</u>
1	Crest.
2	Upstream slope.
3	Spillway and spillway discharge channel.
4	Spillway crest.
5	Downstream end of spillway discharge channel.
6	Plunge basin.
7	Gate controls.
8	Outlet end of "blow-off" pipe.
9	"Blow-off" pipe stilling basin.
10	Minor seepage on south abutment (see Plate 3).
11	Bridge No. 1.
12	Bridge No. 2.



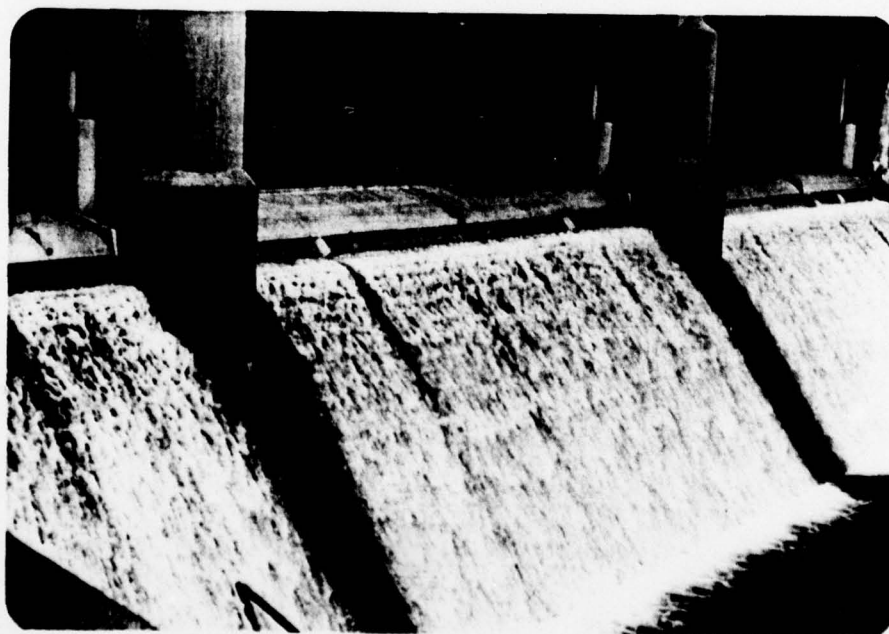
Photograph No. 1
Crest (looking south).



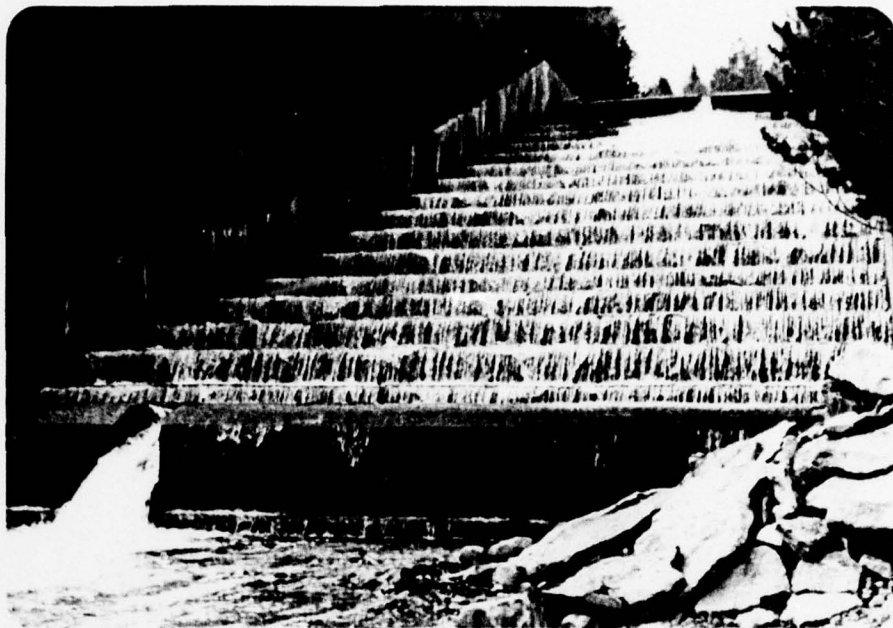
Photograph No. 2
Upstream slope (looking north).



Photograph No. 3
Spillway and spillway discharge channel.



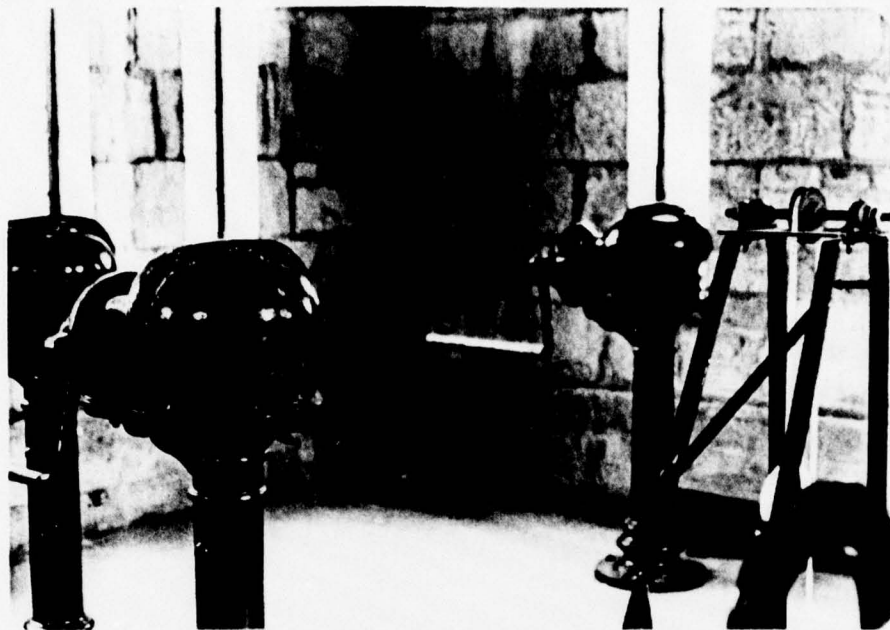
Photograph No. 4
Spillway crest. Note bascule gates (open).



Photograph No. 5
Downstream end of spillway discharge channel.

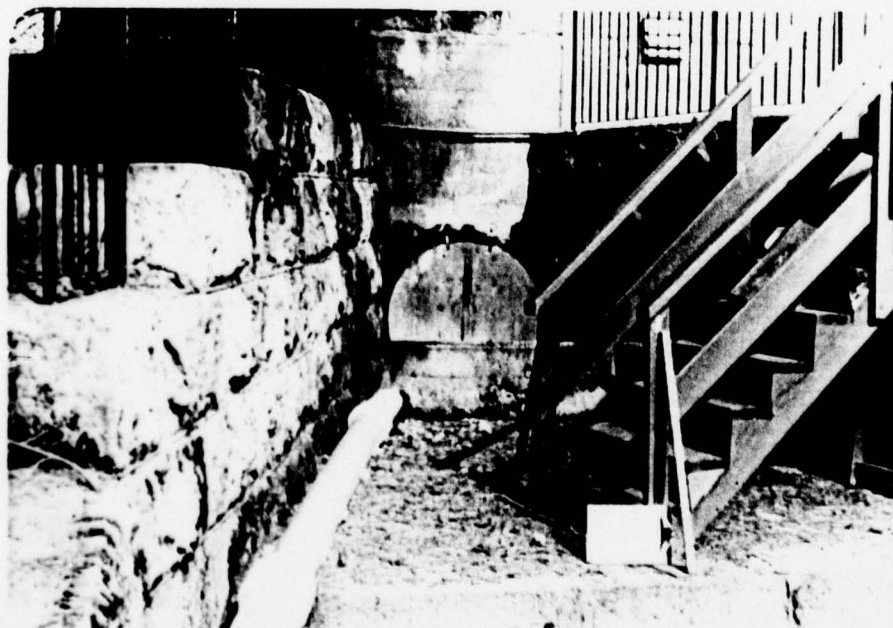


Photograph No. 6
Plunge basin. Note outlet works discharge pipe at the middle of photograph.



Photograph No. 7

Gate controls. Located in the gate house on the crest.



Photograph No. 8

Outlet end of "blow-off" pipe.



Photograph No. 9
"Blow-off" pipe stilling basin.

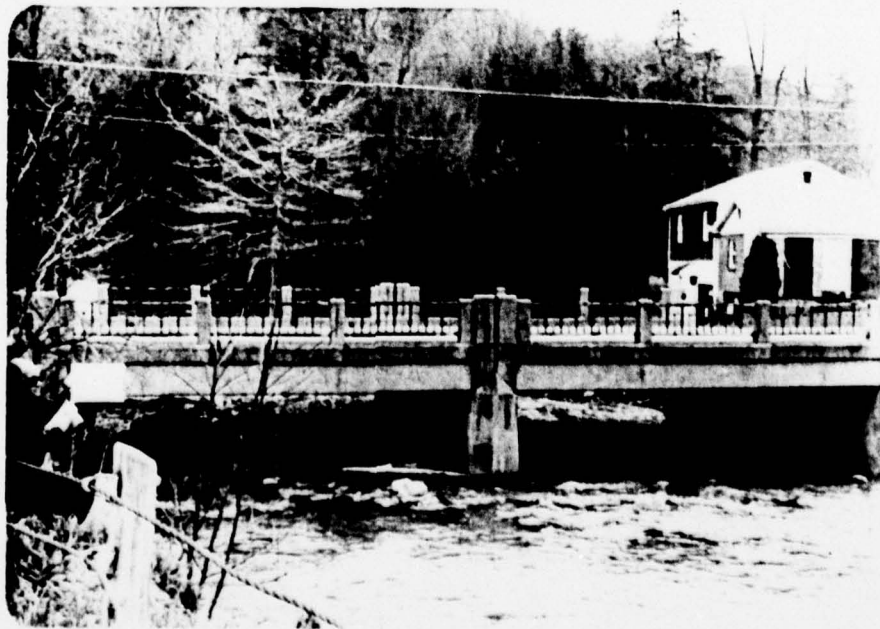


Photograph No. 10
Minor seepage on south abutment (see Plate 3).



Photograph No. 11

Bridge No. 1 (see field sketch in Appendix A).



Photograph No. 12

Bridge No. 2 (see field sketch in Appendix A).

APPENDIX D
CALCULATIONS

D'APOLONIA

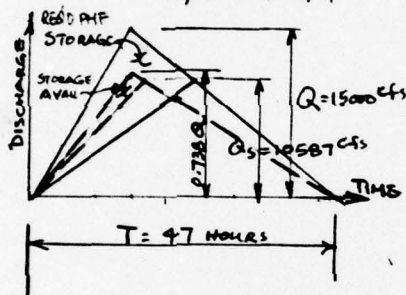
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By WTC Date 4-28-78 Subject NORTH FORK RESERVOIR Sheet No. 1 of 3
 Chkd. By BE Date 5-9-78 HYDROLOGY & HYDRAULICS Proj. No. 78-14-02

DAM : NORTH FORK DAM ; NDS I.D. # 234
 SOMERSET COUNTY, CONEMAUGH TOWNSHIP, PENN.
 WATERSHED AREA, A: 10 SQ. MILE

INFLOW HYDROGRAPH : BASIN : OHIO RIVER BASIN; NORTH FORK OF BENS CREEK



TOTAL TIME, $T_s = 47$ HOURS

PMF PEAK FLOW, $q = 1500$ cfs/mi²

PMF PEAK FLOW, $Q = q \cdot A = 15000$ cfs

$$\begin{aligned} \text{VOLUME OF INFLOW HYDROGRAPH} \\ V_i &= \frac{1}{2} T \times 3600 \times Q \quad \text{CF} \\ &= 1800 T \times Q \times 10^{-6} \quad \text{MCF} \\ &= 1269 \quad \text{MCF} \end{aligned}$$

SPILLWAY CAPACITY

TYPE : OGEE W/GATE $C = 3.6$ (assumed)

LENGTH L 93' (NET LENGTH)

HEAD (MAX.) h , 10 FT

$$Q_s = C L h^{1.5} \quad \text{cfs}$$

$$= 10587 \quad \text{cfs}$$

$$\begin{aligned} \text{RESERVOIR CAPACITY, } V_R &= 94 \text{ ACRES (NORMAL POOL)} \times 10' \text{ (DAM CREST TO SPILLWAY)} \\ &= 940 \text{ AL-FT} = 40.9 \text{ MILLION CU. FT} \end{aligned}$$

$$\text{REQ'D RESERVOIR CAPACITY} = \left(1 - \frac{\text{MAXI. SPILLWAY CAPACITY}}{\text{PMF PEAK FLOW}}\right) (\text{VOLUME OF INFLOW})$$

$$= \left(1 - \frac{Q_s}{Q}\right) (V_i) = \left(1 - \frac{10587}{15000}\right) (1269)$$

$$= 373.3 \quad \text{MCF} > V_R = 40.9 \text{ MCF N.G.}$$

D'APPOLONA

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By WJC Date 4-28-78 Subject NORTH FORK RESERVOIR Sheet No. 2 of 3
Chkd. By BE Date 5-9-78 HYDROLOGY & HYDRAULIC Proj. No. 78-114-02

PERCENT OF PMF WITHOUT OVERTOPPING

$$= \frac{\frac{10587}{15000} (1269 \times 10^6) + 40.9 \times 10^6}{1269 \times 10^6} \times 100\%$$

$$= 73.8\% \text{ PMF}$$

FOR $\frac{1}{2}$ PMF

$$Q = \frac{15000}{2} = 7500 \text{ cfs}$$

$$V_1 = \frac{1269 \times 10^6}{2} = 635 \times 10^6 \text{ CF}$$

MAX. SPILLWAY FLOW RATE = $(1 - \frac{\text{VOL of STORAGE}}{\text{VOL of INFLOW}})$ @ PMF Q)
@ $\frac{1}{2}$ PMF. (Approximate)

$$= (1 - \frac{40.9 \times 10^6}{635 \times 10^6}) (7500)$$

$$= (0.94)(7500)$$

$$= 7020 \text{ cfs}$$

$$Q_s = (3.6)(93)(h)^{1.5} = 7020$$

$$h = 7.6 \text{ FT}$$

$$\text{VOL of storage} = 41.1 \times 10^6 \text{ FT}^3 \approx 40.9 \times 10^6 \text{ OK}$$

\therefore SPILLWAY PASSES $\frac{1}{2}$ PMF W/ $\approx 2.4 \text{ FT}$ FREEBOARD.

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DAPIPOLONA

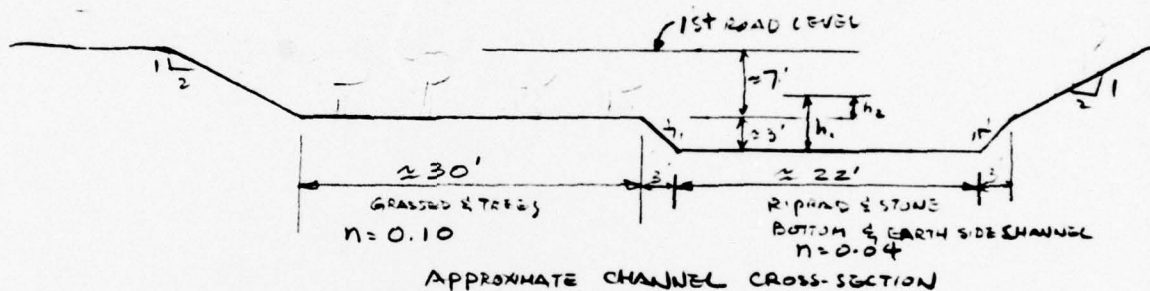
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By WTC Date 4-29-78 Subject NORTH FORK RESERVOIR Sheet No. 3 of 3
Chkd. By BE Date 5-9-78 HYDROLOGY & HYDRAULIC Proj. No. 78-114-02

ESTIMATE WATER DEPTH IN CHANNEL & FLOOD PLAIN @ 500' D/S

CHANNEL SLOPE (FROM U.S.G.S) = 1% (APPROXIMATELY)



CHANNEL PORTION $A = 25 \times 3 = 75 \text{ SF}$
 $P = 22 + 2\sqrt{2} \times 3 = 30.49 \text{ FT}$
 $R = \frac{75}{30.49} = 2.46 \text{ FT}$

$V = \frac{1.486}{0.04} (2.46)^{2/3} (0.01)^{1/2} = 6.8 \text{ FPS}$

$Q = 6.77 \times 75 = 508 \text{ cfs}$

Flood Plain $n = \frac{1}{2} 0.1 + \frac{1}{2} 0.001 = 0.05$ $\left\{ \begin{array}{l} A = (58 + 2h_2)(h_2) \\ P = 30 + 2\sqrt{5} h_2 \end{array} \right.$

$h_2 \text{ ft}$	$A \text{ ft}^2$	$P \text{ ft}$	$R \text{ ft}$	$V \text{ fps}$	$Q \text{ cfs}$	$Q_{\text{TOTAL}} \text{ cfs}$	$V_{\text{max}} \text{ fps}$
1	60	34.97	1.74	4.3	258	766	5.7
2	124	38.9	3.18	6.4	798	1306	6.6
4	264	47.9	5.5	9.3	2449	2957	8.7
6	420	56.8	7.4	11.3	4736	5244	10.6
8	592	65.8	9.0	12.9	7613	8120	12.2
10	780	74.7	10.4	14.2	11072	11580	13.5 $\approx Q_{\text{max}}$

FULL FLOW FROM THE SPILLWAY WILL PROBABLY OVER-TOP THE FIRST ROAD EMBANKMENT.

APPENDIX E
REGIONAL GEOLOGY

APPENDIX E REGIONAL GEOLOGY

A preliminary review of regional geology indicates that the site is in the Allegheny Mountain section of the Upper Appalachian Plateau province. The dam is located on the east limb of the Laurel Hill Anticline. The rock strata at the site dip approximately 300 feet per mile to the east. The bedrock at the dam location consists of interbedded sandstone, shale, and claystone belonging to the Conemaugh Series. Below this rock are gray fine- to medium-grained thick-bedded sandstones with some interbeds of black shale and the Upper and Lower Freeport and Upper, Middle and Lower Kittanning coal seams. No feature of the regional geology should adversely affect the performance of water retention structures founded in these formations.